

Jones, Simon

From: Saksida, Sonja
Sent: Monday, January 9, 2017 8:34 AM
To: Jones, Simon; Keith, Ian
Cc: Paylor, Adrienne
Subject: RE: CRWG/ENG0 - DFO Science meeting

Follow Up Flag: Follow up
Flag Status: Flagged

Slice tolerance has been observed in a couple of areas – AMD veterinarians are aware of these
These have been managed by following the farms to break the cycle. Hydrogen peroxide is now available to be used
and will be used as part of a product rotation

Sonja Saksida DVM, MSc
Lead Veterinarian - Pacific Region
Fisheries and Oceans Canada | Pêches et Océans Canada
Telephone | Téléphone: 902 210 8912

Sonja.Saksida@dfo-mpo.gc.ca

From: Jones, Simon
Sent: Monday, January 09, 2017 8:23 AM
To: Saksida, Sonja; Keith, Ian
Cc: Paylor, Adrienne
Subject: FW: CRWG/ENG0 - DFO Science meeting

Hi Folks,

I have been tapped to attend and present at the attached meeting this Thursday. This will be a very high level over-view
of sea lice research. Apparently there is considerable interest in sea lice resistance to medications used in BC.

What is the current position/activities of AMD on this topic? I will contact communications for the most up to date
media lines.

Thanks,

Simon

From: Chamberlain, Jon
Sent: January-04-17 4:34 PM
To: [REDACTED]
Cc: [REDACTED] Calla, Karen; Lavigne, Lauren; [REDACTED] Taylor, Nathan; Choi, Shirley;
Sutherland, Terri; Chandler, Peter; Jones, Simon; Houston, Kim; Kennedy, Eddy
Subject: RE: CRWG/ENG0 - DFO Science meeting

[REDACTED]

s.19(1)

Following up on my last email about the meeting next week, I've rejigged the draft agenda – see attached. Hopefully this provides ample opportunities for extended questions and discussions on the range of issues being covered. In terms of the roundtable, I am happy to talk about the Integrated Pest Management review that has been moving forward over the last year. We also wondered whether you would be able to provide some initial thoughts and feedback on the recent CSAS process that you attended in December – more on how the process went rather than the actual outcomes which I understand are still under CSAS review.

Please let me know if you have any comments or further recommendations – we are looking forward to some productive and informative discussions next week.

Thanks
JC

From: Chamberlain, Jon

Sent: December-20-16 2:51 PM

To: [REDACTED]

Cc: [REDACTED]

[REDACTED] Calla, Karen; Lavigne, Lauren; [REDACTED] Taylor, Nathan; Choi, Shirley; Sutherland, Terri; Chandler, Peter; Jones, Simon; Houston, Kim; Kennedy, Eddy

Subject: RE: CRWG/ENG0 - DFO Science meeting

Hi [REDACTED]

Thanks for the update – given the time of year and holiday season, I really don't see us being able to get alternate DFO staff to commit and prepare for the meeting on the 12th. Where appropriate, we can certainly go over the ongoing disease/pathogen research being undertaken in the Pacific Region at DFO in the overview. If there is little appetite to explore hard bottom issues, we could defer this presentation. One suggestion could be to use this time to go over the sea lice monitoring data that should be posted in the near future, as well as [REDACTED] work on the spatial distribution in BC of PRV in wild salmonids. Also, the hydrodynamic modeling work that Peter Chandler is on deck to present is very relevant to both sea lice and pathogen transfer issues and I would suggest that this is kept on the agenda if at all possible.

I would hope that 3.5 hours is sufficient to cover this ground and hope we can make some progress on shared understanding of this important work.

Lauren Lavigne will be taking the reins on this one for the rest of the month [REDACTED] – I will rejoin in the new year.

Seasons best
JC

From: [REDACTED]

Sent: December-19-16 10:27 AM

To: Chamberlain, Jon

Cc: [REDACTED]

[REDACTED] Calla, Karen; Lavigne, Lauren; [REDACTED] Taylor, Nathan; Choi, Shirley; Sutherland, Terri; Chandler, Peter; Jones, Simon; Houston, Kim; Kennedy, Eddy

Subject: Re: CRWG/ENG0 - DFO Science meeting

Hi Jon,

The CRWG had a chance to chat about the agenda and there were some suggestions.

At this point in time, we're primarily interested in disease, pathogen and sea lice related research. So we were wondering if the benthic and hydrodynamic modelling work could be replaced with more details on disease/sealice/pathogen related research projects?

We're also interested in updates around potential resistance developing in sea lice and any work around all the approved and experimental treatments being used in BC. Also, we're interested in any work relating to these treatments and their environmental effects (e.g., on crustaceans).

On the ENGO side, [REDACTED] will speak about some of her work on the spatial distribution in BC of PRV in wild salmonids.

Given that we frequently run out of time in meetings with DFO because of extended discussion and questions, we were also wondering if we could schedule in another hour to ensure robust time for questions and discussion? This may entail beefing up the feedback period at the end of the meeting?

If I've missed anything from the CRWG side, folks, please pipe-up.

Thanks much.

[REDACTED]

[REDACTED]

www.watershed-watch.org

Watershed Watch Salmon Society
Office 8236
200 – 375 Water Street
Vancouver, BC V6B 0M9

-----Original Message-----

From: Chamberlain, Jon <Jon.Chamberlain@dfo-mpo.gc.ca>

To: [REDACTED]

Cc: [REDACTED]

[REDACTED]
Calla, Karen <Karen.Calla@dfo-mpo.gc.ca>, Lavigne, Lauren <Lauren.Lavigne@dfo-mpo.gc.ca>, [REDACTED]
[REDACTED] Taylor, Nathan <Nathan.Taylor@dfo-mpo.gc.ca>, Choi, Shirley
<Shirley.Choi@dfo-mpo.gc.ca>, Sutherland, Terri <Terri.Sutherland@dfo-mpo.gc.ca>, Chandler, Peter
<Peter.Chandler@dfo-mpo.gc.ca>, Jones, Simon <Simon.Jones@dfo-mpo.gc.ca>, Houston, Kim
<Kim.Houston@dfo-mpo.gc.ca>, Kennedy, Eddy <Eddy.Kennedy@dfo-mpo.gc.ca>

Subject: CRWG/ENGO - DFO Science meeting

Sent: 13 Dec '16 17:02

As per previous email – meeting request for CRWG/ENGO – DFO Science meeting

****La version française suit****

Jon Chamberlain invites you to an online meeting using WebEx.

Meeting Number: 550 564 377

Meeting Password: [REDACTED]

To join this meeting

- 1. Go to <https://pwgsc-nh.webex.com/pwgsc-nh/j.php?MTID=m29dad71a199877c251278a42cc3be83d>
2. Enter the meeting password: [REDACTED]
3. Click "Join Now".
4. Follow the instructions that appear on your screen.

Teleconference information

Call-in toll-free number: 1-877-413-4788 (Canada)

Call-in number: 1-613-960-7513 (Canada)

Conference ID: [REDACTED]

For assistance

- 1. Go to <https://pwgsc-nh.webex.com>
2. On the left navigation bar, click "Support".
3. Call 1-800-226-6338 or 613-941-9554

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Jon Chamberlain vous invite à une réunion en ligne WebEx.

s.16(2)(c)

Numéro de la réunion : 550 564 377

Mot de passe de la réunion : [REDACTED]

Pour prendre part à cette réunion

1. Allez sur <https://pwgsc-nh.webex.com/pwgsc-nh/j.php?MTID=m29dad71a199877c251278a42cc3be83d>
2. Saisissez le mot de passe de la réunion : [REDACTED]
3. Cliquez sur Prendre part maintenant.
4. Suivez les instructions à l'écran.

Pour Participer uniquement à la téléconférence

Call-in toll-free number: 1-877-413-4788 (Canada)
Call-in number: 1-613-960-7513 (Canada)
Conference ID: [REDACTED]

Pour obtenir de l'aide

1. Allez sur le site <https://pwgsc-nh-fr.webex.com>
2. Dans la barre de navigation, à gauche, cliquez sur Assistance.
3. Composez numéro sans frais: 1-800-226-6338 ou 613-941-9554

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END:DAYLIGHT

s.16(2)(c)

END:VTIMEZONE

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en":MAILTO:Karen.Calla@dfp-mfp.gc.ca

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auren":MAILTO:Lauren.Lavigne@dfp-mfp.gc.ca

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ATTENDEE;ROLE=OPT-PARTICIPANT;PARTSTAT=NEEDS-ACTION;RSVP=TRUE;CN="Taylor, Na

than":MAILTO:Nathan.Taylor@dfp-mfp.gc.ca

ATTENDEE;ROLE=OPT-PARTICIPANT;PARTSTAT=NEEDS-ACTION;RSVP=TRUE;CN="Choi, Shir

ley":MAILTO:Shirley.Choi@dfp-mfp.gc.ca

ATTENDEE;ROLE=OPT-PARTICIPANT;PARTSTAT=NEEDS-ACTION;RSVP=TRUE;CN="Sutherland

, Terri":MAILTO:Terri.Sutherland@dfp-mfp.gc.ca

ATTENDEE;ROLE=OPT-PARTICIPANT;PARTSTAT=NEEDS-ACTION;RSVP=TRUE;CN="Chandler,

Peter":MAILTO:Peter.Chandler@dfp-mfp.gc.ca

ATTENDEE;ROLE=OPT-PARTICIPANT;PARTSTAT=NEEDS-ACTION;RSVP=TRUE;CN="Jones, Sim

on":MAILTO:Simon.Jones@dfo-mpo.gc.ca
ATTENDEE;ROLE=OPT-PARTICIPANT;PARTSTAT=NEEDS-ACTION;RSVP=TRUE;CN="Houston, K
im":MAILTO:Kim.Houston@dfo-mpo.gc.ca
ATTENDEE;ROLE=OPT-PARTICIPANT;PARTSTAT=NEEDS-ACTION;RSVP=TRUE;CN="Kennedy, E
ddy":MAILTO:Eddy.Kennedy@dfo-mpo.gc.ca
ATTACH:CID:C2E1CA485C9C3D4E9755C652341028A9@DFO-MPO.GC.CA
DESCRIPTION;LANGUAGE=en-US:\n\nAs per previous email – meeting request for CRWG/ENGO – DFO Science meeting\n\n****La version française suit****\n\nJon Chamberlain invites you to an online meeting using WebEx.\n\nMeeting Number: 550 564 377\n\nMeeting Password: [REDACTED]\n\n-----\n\nTo join this meeting\n\n-----\n\n1. Go to <https://pwgsc-nh.webex.com/pwgsc-nh/j.php?MTID=m29dad71a199877c251278a42cc3be83>\n\n2. Enter the meeting password: [REDACTED]\n\n3. Click "Join Now".\n\n4. Follow the instructions that appear on your screen.\n\n\n\n-----\n\nTeleconference information\n\n-----\n\nCall-in toll-free number: 1-877-413-4788 (Canada)\n\nCall-in number: 1-613-960-7513 (Canada)\n\nConference ID: [REDACTED]\n\n-----\n\nFor assistance\n\n-----\n\n1. Go to <https://pwgsc-nh.webex.com>\n\n2. On the left navigation bar, click "Support".\n\n3. Call 1-800-226-6338 or 613-941-9554\n\n\nIMPORTANT NOTICE: This WebEx service includes a feature that allows audio and any documents and other materials exchanged or viewed during the session to be recorded. By joining this session, you automatically consent to such recordings. If you do not consent to the recording, discuss your concerns with the meeting host prior to the start of the recording or do not join the session. Please note that any such recordings may be subject to discovery in the event of litigation.\n\n\n*****\n\nJon Chamberlain vous invite à une réunion en ligne WebEx.\n\nNuméro de la réunion : 550 564 377\n\nMot de passe de la réunion : [REDACTED]\n\n-----\n\nPour prendre part à cette réunion\n\n-----\n\n1. Allez sur <https://pwgsc-nh.webex.com/pwgsc-nh/j.php?MTID=m29dad71a199877c251278a42cc3be83>\n\n2. Saisissez le mot de passe de la réunion : [REDACTED]\n\n3. Cliquez sur Participer maintenant.\n\n4. Suivez les instructions à l'écran.\n\n\n\n-----\n\nPour Participer uniquement à la téléconférence\n\n-----\n\nCall-in toll-free number: 1-877-413-4788 (Canada)\n\nCall-in number: 1-613-960-7513 (Canada)\n\nConference ID: [REDACTED]\n\n-----\n\nPour obtenir de l'aide\n\n-----\n\n1. Allez sur le site <https://pwgsc-nh-fr.webex.com>\n\n2. Dans la barre de navigation, à gauche, cliquez sur Assistance.\n\n3. Composez numéro sans frais: 1-800-226-6338 ou 613-941-9554\n\n\nREMARQUE IMPORTANTE : Ce service WebEx comprend une fonction qui permet d'échanger ou de consulter des fichiers audio et tout document et autre matériel pendant l'enregistrement de la session. En vous joignant à cette session, vous autorisez automatiquement l'enregistrement.

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à la session.\n\n\n

SUMMARY;LANGUAGE=en-US:CRWG/ENGO - DFO Science meeting

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PRIORITY:5

DTSTAMP:20161214T010146Z

TRANSP:OPAQUE

STATUS:CONFIRMED

SEQUENCE:1

LOCATION;LANGUAGE=en-US:Fisheries and Oceans Canada RHQ - 401 Burrard St.

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END:VEVENT

END:VCALENDAR

Jones, Simon

From: Rainer, Michelle
Sent: Monday, January 9, 2017 2:40 PM
To: Jones, Simon
Subject: RE: Sea Lice ML
Attachments: ML_AQUA_BroughtonLicePaper.docx

Follow Up Flag: Follow up
Flag Status: Flagged

Hi Simon,

Attached are the most recent lines related to sea lice. Is this what you're looking for? If not, please give me a call.
Thanks,
Michelle

From: Jones, Simon
Sent: 2017-January-09 8:27 AM
To: Rainer, Michelle
Subject: Sea Lice ML

Hi Michelle,

Would you please me send the most recent sea lice media lines.

Thanks,

Simon

Simon R.M. Jones
*Aquatic Animal Health Section
Pacific Biological Station
Fisheries and Oceans Canada
3190 Hammond Bay Road
Nanaimo, British Columbia
V9T 6N7, Canada*

Tel: 250 729 8351
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<https://scholar.google.ca/citations?user=JIvmjCwAAAAJ&hl=en>

MEDIA LINES

Research paper on sea lice in B.C.'s Broughton Archipelago

A group of researchers [REDACTED] recently published a paper in the *Canadian Journal of Fisheries and Aquatic Sciences* proposing that poorly timed parasiticide treatments at salmon farms contributed to increased numbers of sea lice in the Broughton Archipelago in 2015. Fisheries and Oceans Canada (DFO) scientists and fish health veterinarians are reviewing the paper.

Media lines

- Unusual conditions in the Broughton Archipelago are believed to have contributed to increased sea lice abundance in 2015. Seasonal and year-to-year variations in ocean salinity, temperature and other environmental conditions are known to influence the abundance of naturally occurring sea lice.
- Exceptionally high numbers of returning pink salmon to the Broughton Archipelago in late 2014 and early 2015 may also have contributed to higher numbers of sea lice. Research (www.pnas.org/content/107/52/22599.abstract) has demonstrated a relationship between the strength of the previous year's salmon run and the risk of sea lice infestation to juvenile salmon in the current year.
- Fisheries and Oceans Canada's (DFO's) Conditions of Licence for aquaculture require strict ongoing inspection of farmed fish to monitor sea lice levels and implementation of management measures so that sea lice numbers are at their lowest during the outmigration of wild juvenile salmon.
- As required by licence conditions, facilities in the Broughton Archipelago increased their monitoring and management actions whenever more than three motile sea lice (these are lice in the free-moving stages of their life cycle) per fish are detected during the juvenile salmon outmigration period of March 1 to June 30. More information can be found at www.pac.dfo-mpo.gc.ca/aquaculture/reporting-rapports/lice-pou-eng.html.
- During the remainder of the year, licence holders must monitor and report to DFO when levels reach the three motile threshold. To avoid unnecessary or over-treatment, options are assessed during this period before treatment is implemented.
- In autumn, adult wild salmon return to their spawning grounds. During this period, these fish carry high numbers of sea lice, which can infect farmed salmon. To avoid unnecessary or over-treatment, the best management practice is to wait until the wild migration period is complete before performing any direct sea lice management measures on farmed salmon.
- DFO is a science-based department and our management of aquaculture and other fisheries is based on sound science advice. DFO has an ongoing, active research

s.19(1)

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Created on: 21-Jul-16
Created by: Rainer, Michelle
Docket #: 333/16

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Revised: 5-Aug-16 10:58 AM
APPROVED: 5-AUG-16

program to build on its current understanding of the interactions between wild juvenile salmon and salmon farming, including studies on sea lice.

General sea lice management (pre-approved)

- Under the *Pacific Aquaculture Regulations*, DFO requires salmon farming companies to regularly monitor and manage sea lice levels at their sites.
- Licence holders must regularly report sea lice levels to DFO, the results of which are posted online at www.pac.dfo-mpo.gc.ca/aquaculture/reporting-rapports/lice-pou-eng.html.
- DFO research has shown that sea lice numbers on wild salmon were the same, and in some cases higher, in marine waters situated far away from salmon farms as the numbers counted on wild salmon near farms.

Responsive

If pressed on the effectiveness of SLICE:

- SLICE continues to be an effective treatment for sea lice at aquaculture facilities in the Broughton Archipelago.
- There are well established methodologies and protocols to quantify the effectiveness of therapeutants and to determine when resistance has developed within target populations. Companies continue to assess the sensitivity of sea lice to SLICE in the lab.
- Any reduction in effectiveness of the drug is not necessarily an indication of resistance.

Spokespeople:

Simon Jones, Aquaculture Research Scientist, 250-729-8351
Sonja Saksida, Lead Veterinarian, 250-703-0917

Program Contacts:

Simon Jones, Aquaculture Research Scientist, 250-729-8351
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Communications Contact:

Michelle Rainer, Communications Advisor, 604-775-5065

Jones, Simon

From: Keith, Ian
Sent: Wednesday, January 11, 2017 9:19 AM
To: Jones, Simon
Subject: RE: slide review
Attachments: Saksida review 2015 revie koop.pdf

Follow Up Flag: Follow up
Flag Status: Flagged

Sorry. Here it is.

And I had to finish something else yesterday but will have checked your table by noon today.

Dr. Ian Keith DVM
Field Operations Veterinarian - Pacific Region
Fisheries and Oceans Canada | Pêches et Océans Canada
Fisheries Management
Aquaculture Management Division | Gestion de l'aquaculture
Aquaculture Environmental Operations - Fish Health
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Telephone | Téléphone: 250-703-0917
Mobile | Portable: [REDACTED]
Fax | Télécopieur: 250-703-0921
Ian.Keith@dfo-mpo.gc.ca

From: Jones, Simon
Sent: Wednesday, January 11, 2017 7:44 AM
To: Keith, Ian
Subject: RE: slide review

Ian, this link doesn't work.

From: Keith, Ian
Sent: January-10-17 9:52 PM
To: Jones, Simon
Subject: RE: slide review

[www.asc-aqua.org/.../\(141\)_VR2_20160121_Marine%20Harvest%20Ca](http://www.asc-aqua.org/.../(141)_VR2_20160121_Marine%20Harvest%20Ca)

Hi Simon. This is the review I was referring to.

Dr. Ian Keith DVM
Field Operations Veterinarian - Pacific Region
Fisheries and Oceans Canada | Pêches et Océans Canada
Fisheries Management
Aquaculture Management Division | Gestion de l'aquaculture
Aquaculture Environmental Operations - Fish Health
#103 - 2435 Mansfield Drive
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Telephone | Téléphone: 250-703-0917
Mobile | Portable: [REDACTED]

s.16(2)(c)

Fax | Télécopieur: 250-703-0921
Ian.Keith@dfo-mpo.gc.ca

From: Jones, Simon
Sent: Tuesday, January 10, 2017 3:29 PM
To: Keith, Ian
Subject: slide review

Hi Ian,
I you have a minute, would you please comment on the accuracy of the attached slide.
I would like to use it for context in my talk on Thursday.

Thanks, Simon

Simon R.M. Jones
*Aquatic Animal Health Section
Pacific Biological Station
Fisheries and Oceans Canada
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Nanaimo, British Columbia
V9T 6N7, Canada*

Tel: 250 729 8351
Fax: 250 756 7053
E-mail: simon.jones@dfo-mpo.gc.ca

<https://scholar.google.ca/citations?user=JIvmjCwAAAAJ&hl=en>

A SUMMARY OF SEA LICE IN BC – WILD AND FARMED MONITORING AND MANAGEMENT

PREPARED BY: SONJA SAKSIDA¹, DVM, MSC
REVIEWED BY: DRS CRAWFORD REVIE² AND BEN KOOP³

¹Sea to Sky Veterinary Services; ²Canada Research Chair – Population Health: *Epi-Informatics*; Department of Health Management, Atlantic Veterinary College, University of Prince Edward Island; ³Professor and Canada Research Chair; Biology/Centre for Biomedical Research, University of Victoria

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1 INTRODUCTION

THE IRRATIONALITY OF USING NORWEGIAN THRESHOLD CRITERIA FOR MANAGEMENT OF *LEPEOPHTHEIRUS SALMONIS* ON ATLANTIC SALMON FARMED IN BRITISH COLUMBIA, CANADA

The current sea lice management program in British Columbia requires salmon farms to maintain sea lice levels below 3 motile *Lepeophtheirus salmonis* between March and July, during the perceived period of outmigration of juvenile pink salmon. This criterion was established in 2003 to address concerns of perceived negative impacts that lice from farms may be having on wild pink salmon populations. The BC sea lice threshold level, however, was not based on scientific evidence but instead was determined by government and industry as a level that would support precautionary management while more scientific data were gathered to better inform the issues - specifically the effect sea lice had on wild juvenile salmon. This precautionary level was an acknowledgement of: 1) the lack of serious pathology occurring on BC farmed salmon compared to other jurisdictions that had *L. salmonis*, and 2) the large populations of wild salmon in BC that are known to carry sea lice and thus influence the sea lice abundance on farmed salmon, particularly during the autumn months. The threshold level in BC (3 motile *L. salmonis*) was, in fact, at the time (i.e. 2003) lower than that prescribed in Norway (6 motile *L. salmonis*) during the same period of time.

It has been over 12 years since the threshold was established in BC, and there have been several key findings that would suggest lower thresholds would not benefit either the wild or farmed salmon populations. These include

- The *L. salmonis* occurring in the Pacific is actually a physically isolated (~5MY) subspecies compared to that found in the Atlantic Ocean
- *L. salmonis* is found at high prevalence and intensity on wild returning salmon
- Pink salmon, the original species that sounded concern around lice levels, are actually highly resistant to sea lice once they reach 1 gram, and as adults have been suggested to be the natural hosts for *L. salmonis*.

- Juvenile pink and coho salmon are the most resistant to *L. salmonis* while sockeye, chum and Atlantic salmon are less so. Chinook salmon tolerance to *L. salmonis* is situated somewhere in between these two groups.
- Farmed Atlantic salmon although reported to more susceptible to *L. salmonis* show little to no health issues at the reported lice levels even in the autumn when exposed to high lice levels from returning wild Pacific salmon.
- Sea lice levels vary seasonally, annually and regionally on both farmed and wild salmon
- Salmon species predilection to lice species may also vary
- In one farming area (Broughton Archipelago) the number of pink salmon returning as adults actually predicts the number of sea lice on farmed salmon in the next spring, as well as the prevalence of lice on the out-migrating wild juvenile. Simply put this means when salmon returns are good, sea lice numbers will be high and vice versa but this does not have an association with ultimate survival of the population. Furthermore, reports have been published to suggest that the current threshold is working.
- Abundance of the various Pacific salmon species varies considerably between the regions in British Columbia. For example on the west coast of Vancouver Island there are no pink salmon runs. Emergence from the rivers into the marine environment varies by salmon species and geographical location.
- There are overlaps in migration timing/routes in the nearshore environment between returning adult and juvenile salmon when/where sea lice from wild adult salmon can readily transfer to the out migrating juvenile salmon. This is usually mid to late spring/summer.

The following document summarizes the state of knowledge in British Columbia. However, the research suggests that alternative management choices for sea lice on farms may better serve both the wild and farmed salmon populations in British Columbia. These alternatives could include:

- Modifying the period of threshold compliance to be more specific to the salmon species of relevance to each farming region or areas that are linked hydrographically.

- Develop predictive models using climate and hydrographic information to determine time of emergence and thus the period of threshold control.
- Establish more robust Integrated Pest Management (IPM) programs that include additional treatment options to reduce the chance of resistance developing to any one product, in addition to other important husbandry and production activities such as fallowing and single year class sites.

There may be other options that could be developed but it is unlikely that setting thresholds at the level of 0.1 adult female *L. salmonis* during critical periods as done in Norway would be considered. There are several reasons why, in the British Columbia environment, this would be unreasonable and ill-advised. These include principally:

- The ratio of wild (adult) to farmed salmon in BC has been suggested to be 1000:1 while in Norway the ratio is reversed at 1:1000, illustrating the completely different ecological environment in which farms are operating.
- Differences in environment – less saline water.
- Differences in species of concern.

Under the current threshold system of 3 motile *L. salmonis*, there has been no evidence to suggest salmon populations have been negatively impacted in British Columbia. Thus, forcing even lower thresholds on an ecosystem where the current level is showing to be a level of no negative effect would result in increased therapeutant use, more product released into the ecosystem unnecessarily, and impact non-target organisms and the benthos. Furthermore, it could potentially accelerate the development of therapeutant tolerance or resistance to the product in the sea lice –jeopardizing future control and management options.

Therefore, it is more reasonable and prudent to establish sea lice criteria based on the needs of the local environment, biology, and ecosystem rather than setting one criteria that though potentially suitable in one ecosystem could have detrimental results in another.

2 SEA LICE AFFECTING SALMON IN BRITISH COLUMBIA

2.1 *Lepeophtheirus salmonis*

- 2.1.1 The species of sea louse most commonly reported on wild (Beamish *et al.* 2005, Patanasatienkul *et al.* 2013, Elmoslemany *et al.* 2015) and farmed salmonids (Saksida *et al.* 2007a) in coastal BC are *Lepeophtheirus salmonis* (*L. salmonis*).
- 2.1.2 Morphologically, *L. salmonis* appear identical between the North Pacific and the North Atlantic regions.
- 2.1.3 Genetically, however, Todd *et al.* (2004) reported low but significant differentiation in the variation of six microsatellite loci between North Pacific and North Atlantic *L. salmonis*.
- 2.1.4 Yazawa *et al.* (2008) reported significant differences in the nuclear DNA sequences and the mitochondrial genome from *L. salmonis* collected from the North Pacific versus the North Atlantic
- 2.1.5 Concluding, there is enough genetic evidence to confidently state that the *L. salmonis* are **distinct** between the North Pacific and the North Atlantic regions.
- 2.1.6 *L. salmonis* occurring in the Pacific are actually a physically isolated (~5MY) subspecies to that found in the Atlantic Ocean (Skern-Mauritzen *et al.* 2014)
- 2.1.7 *L. salmonis* are commonly found in high numbers on native adult Pacific salmon.
- 2.1.8 Pink (*Onchorynchus gorbaschu*) and chum (*Onchorynchus keta*) salmon are considered the 'natural' hosts for the parasite (Nagasawa 2001).
- 2.1.9 However, Jones *et al.* (2006 a, b) describe significant naturally occurring *L. salmonis* infestations on three-spine stickleback (*Gasterosteus aculeatus*) in the wild as well as infestations resulting from controlled laboratory studies.
- 2.1.10 Three-spine stickleback were one of the four most common wild non-salmonid species netted or hooked in a survey of fish near salmon farms (Kent *et al.* 1998).
- 2.1.11 Pert *et al.* (2006, 2009) suggested successful settlement and feeding on non-salmonids allowed *L. salmonis* to use other species as peripatetic (or pratemetic/transport hosts) to improve survival and to aid dispersion until a salmonid host is encountered.
- 2.1.12 Due to their preference for salmonids, *L. salmonis* infections tend to be more chronic and persistent (Integrated Pest Management Report 2003).
- 2.1.13 There are major reports describing large infestations of *L. salmonis* on adult Pacific salmon in coastal waters and the high seas (Nagasawa *et al.* 1993; Johnson *et al.* 1996; Nagasawa 2001; Beamish *et al.* 2005; Trudel *et al.* 2007).

2.2 *Caligus clemensi*

- 2.2.1 The sea louse, *Caligus clemensi* (*C. clemensi*), is common as well, but to a lesser degree than *L. salmonis* (Johnson *et al.* 2004; Patanasatienkul *et al.* 2013).
- 2.2.2 *C. clemensi* has a broad range of hosts including pink, coho (*O. kisutch*), Chinook (*O. tshawytscha*), sockeye (*O. nerka*) and Atlantic salmon (*Salmo salar*) as well as rainbow trout (*O. mykiss*), non-salmonid fishes (e.g. herring (*Clupea pallasii*) and sticklebacks) and elasmobranchs (Parker & Margolis 1964; Beamish *et al.* 2005).
- 2.2.3 Highly motile preadult and adult *Caligus* species often infect farmed salmon (instead of attachment during earlier developmental stages).
- 2.2.4 The prevalence of *C. clemensi* may be underestimated by sampling due to the high motility of these animals.
- 2.2.5 Infections by *Caligus* species tend towards acute and transient (Integrated Pest Management Report 2003).
- 2.2.6 Spawning herring may be a major source of *C. clemensi* for juvenile salmon in coastal BC (Beamish *et al.* 2009).
- 2.2.7 Parker and Margolis (1964) suggested that this ecto-parasite is “specific to environment rather than host” –most likely a reflection of its wide host specificity.

2.3 *Lepeophtheirus cuneifer*

- 2.3.1 *Lepeophtheirus cuneifer* (*L. cuneifer*) is much less common than *L. salmonis* and *C. clemensi* (Kabata 1974).
- 2.3.2 12 known hosts including rainbow trout and Atlantic salmon (Johnson & Albright 1991a)
- 2.3.3 *L. cuneifer* are relatively rare (and possibly not recognized).
- 2.3.4 Adults and pre-adults are highly motile.

3 FISH HEALTH EFFECTS OF *LEPEOPHTHEIRUS SALMONIS* IN BRITISH COLUMBIA

- 3.1 Serious health issues associated with *L. salmonis* infestations on farmed salmon are frequently reported by salmon farming regions located in Europe and Eastern North America, but not in Japan or on the BC coast.
- 3.2 Heavy infections and damage as a result of infections with *L. salmonis* were rare and aquaculture veterinarians did not consider sea lice a serious health concern (Saksida *et al.* 2007a).
- 3.3 This discrepancy in pathology and epidemiology was difficult to explain when the identical-looking Atlantic and Pacific varieties of *L. salmonis* were believed to be the same species.
- 3.4 However, genetic and physiological differences between North Atlantic and Pacific Canadian *L. salmonis* indicate they are likely distinct varieties:
 - 3.4.1 Fast *et al.* (2003) reported considerable differences in physiological reaction (higher protease activity) in coho and Atlantic salmon as well as rainbow trout mucous when exposed to *L. salmonis* collected from BC compared to *L. salmonis* collected from New Brunswick.
 - 3.4.2 Todd *et al.* (2004) reported low but significant differentiation in the variation of six microsatellite loci between North Pacific and North Atlantic *L. salmonis*.
 - 3.4.3 There are significant differences in the nuclear DNA sequences and the mitochondrial genome from *L. salmonis* collected from the North Pacific versus the North Atlantic (Yazawa *et al.* 2008).
 - 3.4.4 Cumulatively, these studies suggest that the North Pacific *L. salmonis* is distinct from the North Atlantic variety thereby explaining why there is such a disparity in pathogenicity and virulence between the two groups.
 - 3.4.5 Studies show that survival and development of *L. salmonis* is optimal in high salinity seawater (Jones & Johnson 2015).
 - 3.4.6 Sutherland *et al.* (2012) characterized the significantly elevated expression of stress-associated genes in *L. salmonis* copepodids maintained in 27‰ seawater compared with 30‰.
 - 3.4.7 Some of the difference in pathogenicity between the two species of *L. salmonis* may be environment related, with the Atlantic Ocean being more saline than the Pacific (<http://www.mbari.org/chemsensor/pteo.htm>).

4 HISTORY OF SEA LICE ON SALMON FARMS IN BRITISH COLUMBIA

- 4.1 Sea lice infestations were not considered a significant fish health issue on salmon farms in BC since pathogenic lesions as described in the literature (Finstad *et al.* 2000) and observed in Europe are rarely observed in BC.
- 4.2 Consequently, prior to 2003, enumeration of sea lice only occurred if there were health and/or welfare concerns at a farm site. Thus treatments for sea lice infestation were rare and limited data were recorded.
- 4.3 An unexpectedly low return of pink salmon in 2002 led to reports in scientific journals and in the popular press suggesting that sea lice from Atlantic salmon farms were negatively impacting juvenile wild pink salmon and, in turn, affecting wild salmon returns.
- 4.4 Salmon farms in the Broughton Archipelago were singled out (farms in this area constituted 35-40% of total farmed Atlantic salmon production in BC between 2000 and 2006).
- 4.5 In response to these accusations, the provincial government instituted stringent sea lice monitoring systems and control measures on salmon farms (described in Saksida *et al.* 2007a).
- 4.6 In March 2003, routine sea lice monitoring began on Atlantic salmon farms in the Broughton Archipelago (originally as part of the Broughton Archipelago Sea Lice Action Plan) (Saksida *et al.* 2007a).
- 4.7 In October 2003, the monitoring program in the Broughton Archipelago was expanded to include all British Columbia salmon farms as part of a provincial management plan known as the Sea Lice Management Strategy.
- 4.8 The Sea Lice Management Strategy stipulates that during the period of juvenile pink salmon migration out of the nearshore (March to July), *L. salmonis* are to be below 3 motile sea lice per fish (including preadult and adult *L. salmonis* stages of both male and female lice).
- 4.9 If *L. salmonis* levels exceed this threshold during March to July, the farmed fish must be treated with medicant or be harvested.
- 4.10 This threshold was lower than that prescribed in Norway at the time (Heuch *et al.* 2005).
- 4.11 The threshold of 3 motile *L. salmonis* was not based on scientific evidence:

- 4.11.1 It was determined by government and industry as a level that would allow precautionary management while more scientific data were gathered to better inform the issue (Rogers *et al.* 2013)
- 4.11.2 It acknowledged both: the lack of serious sea lice disease occurring in BC farmed salmon compared to other global jurisdictions with *L. salmonis*, and the large populations of wild salmon in BC that are known to carry sea lice and thus greatly influence the sea lice abundance on farmed salmon, particularly during the summer to fall return migration season.
- 4.12 In December 2010, Fisheries and Oceans Canada (DFO) took over management of aquaculture in British Columbia (<http://www.dfo-mpo.gc.ca/media/back-fiche/2014/hq-ac06b-eng.htm>).
- 4.12.1 Threshold levels, monitoring and audit programs remained similar to those in place while the provincial government had been responsible.

5 SEA LICE INFECTIONS IN BRITISH COLUMBIA

- 5.1 There are several reports describing sea lice on adult Pacific salmon in coastal waters and the high seas (Nagasawa *et al.* 1993; Johnson *et al.* 1996; Nagasawa 2001; Beamish *et al.* 2005; Trudel *et al.* 2007).
- 5.2 Sea lice on wild juvenile Pacific salmon were first collected in 2001 in the Broughton Archipelago (1 of 7 farming areas in BC) (Morton & Williams 2003).
- 5.3 More systematic monitoring of sea lice of wild juvenile salmon and other coastal fish began in 2004 in the Broughton Archipelago (Jones *et al.* 2007; Krkošek *et al.* 2007) and the Central Coast (Butterworth *et al.* 2008; Saksida *et al.* 2011) and in 2007 in the Discovery Islands (Price *et al.* 2010).
- 5.4 Wild fish monitoring programs exist or have occurred within other salmon farming regions, however have not been published.
- 5.5 Sea lice information has been routinely collected and reported by the salmon farms in British Columbia since 2003/04.
- 5.6 Prior to that period, examinations were intermittent and, as a consequence, data was not readily available.

6 SEA LICE AND WILD FISH IN BRITISH COLUMBIA

- 6.1 There are five main species of wild Pacific Salmon found in North America: pink, chum, coho, Chinook and sockeye
- 6.2 The ratio of wild adult salmon to farmed salmon in British Columbia is ~ 1000:1 (Saksida *et al* 2015). The ratio of wild juvenile salmon (smolts) to farmed salmon must be significantly higher since as estimated survival rates (smolt to adult) range from 0.7% for chum to 9.8% for Coho (Bradford 1995).
- 6.3 Although most salmon stocks are migratory, leaving the nearshore region of BC for feeding grounds offshore, a few stocks (primarily coho) spend their entire marine lifecycle in local waters (Beamish *et al.* 2007).
- 6.4 Large numbers of wild salmon are found in the spring/summer during the out-migration of juvenile salmon and summer/fall when maturing salmon are returning to their natal rivers.
 - 6.4.1 For example between 10 and 40 million Adult Pacific salmon can pass through Queen Charlotte Strait.
- 6.5 Each Pacific salmon species has its own unique life-cycle, although they are all semelparous (die after spawning).
 - 6.5.1 Pink salmon are the most abundant, smallest in size, have the shortest life cycle consisting of distinct even and odd year runs. They emerge into the marine environment shortly after they hatch, and have the highest straying rate.
 - 6.5.2 Chum salmon are also abundant, and like the pink salmon head to the marine environment shortly after hatching where they remain for 2 or 3 years before returning to their natal rivers.
 - 6.5.3 Sockeye salmon remain in freshwater 1 to 3 years and then spend 2 to 3 years in the marine environment.
 - 6.5.4 Chinook are the largest of the Pacific salmon. Young may spend up to a year in freshwater and then between 2 and 7 years in saltwater.
 - 6.5.5 Coho salmon spend 1 to 2 years in freshwater and up to 18 months in the marine environment.
- 6.6 Demography of salmon vary by region
 - 6.6.1 South Coast Mainland region has populations of all 5 species of salmon although the Fraser River does not have even year pink salmon (Marty *et al.* 2010).
 - 6.6.2 Broughton Archipelago has very few sockeye salmon.

- 6.6.3 Central Coast (Klemtu) has no major Chinook salmon runs (Saksida *et al.* 2011)
- 6.6.4 West Coast of Vancouver Island has no major pink salmon runs.
- 6.7 Very little information is available about specific migratory routes for the different stocks; particularly for juvenile stages.
- 6.8 There are several reports describing large infestations of *L. salmonis* on adult Pacific salmon in coastal waters and high seas, without lesions or any evidence of detrimental effects (Nagasawa *et al.* 1993; Johnson *et al.* 1996; Nagasawa 2001; Beamish *et al.* 2005; Trudel *et al.* 2007, see Saksida *et al.* 2015 for summary)
- 6.8.1 Pink salmon, which are at sea for only one year, followed by chum salmon are often the most heavily infected with *L. salmonis* in the high seas (Nagasawa 1985, 2001) and near-shore (Trudel *et al.* 2007), although sea lice have been reported on all five species of wild Pacific Salmon found in North America
- 6.9 High levels of *C. clemensi* infection were also reported on wild Pacific Salmon (Beamish *et al.* 2005). It has been suggested that infection with this parasite is more commonly associated with coastal regions.
- 6.10 Sea lice have been reported on all species of juvenile salmon in the marine environment and levels vary among species (fish and louse species), by geographic location, environment, length of time in seawater and annually (Trudel *et al.* 2007; Rees *et al.* 2015; Elmoslemany *et al.* 2015; see Saksida *et al.* 2015 for summary).
- 6.10.1 Sea lice have been reported on juvenile pink and chum salmon shortly after emergence from the river into the marine environment, at sizes as small as 0.2g. Preponderance of *L. salmonis* versus *C. clemensi* varied spatially and temporally (Patanasatienkul *et al.* 2015).
- 6.10.2 *C. clemensi* was reported to be the predominant louse species on juvenile sockeye salmon in the Discovery Islands and North Coast in a 2 year study (Price *et al.* 2011) and Southern Gulf Islands (Beamish *et al.* 2009); while in one area of the west coast of Vancouver Island fish were almost exclusively infested with *L. salmonis* (Elmoslemany *et al.* 2015).
- 6.11 Considerable debate had centered around the health implications of sea lice on individual juvenile salmon, particularly pink salmon.
- 6.11.1 There appears to be no consensus that minor skin lesions are associated with sea lice attachment on naturally infected pink and chum salmon (Saksida *et al.* 2012; Jakob *et al.* 2013) or that the bleeding at the base of the fins, noted in Morton & Routledge (2005), was related to lice infection rather than stressful environmental conditions or bacterial and viral infections in wild captured juvenile salmon (Marty *et al.* 2010).

- 6.11.2 Naturally infected juvenile chum salmon had higher intensities of infection with *L. salmonis* compared to pink salmon (*Oncorhynchus gorbuscha*) (Jones & Hargeaves 2007, 2009). The pattern was repeated in laboratory exposures in which the parasite was rapidly rejected from juvenile pink compared with juvenile chum salmon (Jones *et al.* 2006b, 2007).
- 6.11.3 Juvenile chum salmon and Atlantic salmon are more susceptible to *L. salmonis* than pink salmon (Sutherland *et al.* 2014)
- 6.11.4 The presence of sea lice does not hinder swimming performance in pink salmon (Nendick *et al.* 2011).
- 6.11.5 A 'no effect' threshold for sublethal disturbance has been reported to as 0.5 g with one chalimus 4 is consistent with the developmental stage at which pink salmon develop scales and exhibit a heightened immunocompetence (Sackville *et al.* 2011; Brauer *et al.* 2012)
- 6.11.6 Furthermore, controlled laboratory studies found the lethal level for pink salmon weighing less than 0.7g to be 7.5 *L. salmonis*/g. Above this size, pink salmon appear to be highly resistant to lice (Jones *et al.* 2008) though they do appear to become more sensitive upon sexual maturity (Braden *et al.* 2014).
- 6.11.7 Pink salmon and coho salmon have been found to reject sea lice (*L. salmonis*) at higher rates than chum, Chinook and sockeye salmon (Jakob *et al.* 2013).
- 6.11.8 *L. salmonis* mature more slowly on coho salmon than on rainbow trout or Atlantic salmon, and research concluded that coho salmon had a relatively high innate immunity to *L. salmonis* (Johnson & Albright 1992; Fast *et al.* 2002) and therefore would likely not be negatively impacted when preying on other juvenile salmon carrying lice as suggested by Connors *et al.* (2010).
- 6.11.9 In laboratory challenge trials more extensive lesions have been reported in sockeye salmon, where adult *L. salmonis* attached near the dorsal fin and sites were characterized grossly by depigmentation, raised scales, bloody exudate and degraded mucus layers; signs of epithelial grazing and parasite-induced damage were not observed on coho or Atlantic salmon (Branden *et al.* 2014).
- 6.12 In summation, studies show that, on a scale, juvenile pink and coho salmon are the most resistant to *L. salmonis* while sockeye, chum and Atlantic are salmon lesser so. Chinook salmon tolerance to *L. salmonis* is situated somewhere in between these two groups.
- 6.13 Considerable debate has centered around population level effects of sea lice

- 6.13.1 Several studies that have attributed population level declines provided evidence of association not causation and used a flawed mortality study (Morton *et al.* 2004) to calculate mortality rates. These studies often did not differentiate sea lice species (Morton *et al.* 2004, 2011; Krkošek *et al.* 2005, 2006a, b, 2007) and compared areas that were very different from one another (Ford & Meyers 2008). This resulted in initial claims that 90% of pink and chum salmon in the Broughton Archipelago were infected at or above lethal limit, which they suggested were 1.6 mobile lice/g (Morton *et al.* 2004), and inappropriately forecasted the extinction of pink salmon populations in the Broughton Archipelago (Krkošek *et al.* 2007).
- 6.13.2 Several of the same authors who had predicted a collapse of wild pink stocks later published a report indicating that survival of pink salmon stocks in the Broughton Archipelago did not statistically differ from a reference region without farms (Morton *et al.* 2011). They attributed this finding to changes in the sea lice management programs on farms, although, as stated above, the areas could have differed in several other ways.
- 6.13.3 However when results from controlled lab study results were incorporated into the analysis – *L. salmonis* induced mortality ranged from 0 to 4.5% for the same periods reported above, leading authors to conclude that sea lice related mortality contributed only minimally to the overall mortality normally experienced during this life-stage (55-77%) of pink salmon (Jones & Hargreaves 2009).
- 6.13.4 Marty *et al.* (2010) reported that the number of pink salmon returning to spawn in the fall predicts the number of female *L. salmonis* on farms in the next spring which in turn accounts for 98% of the variation in sea lice prevalence seen in the out migrating juvenile salmon in the Broughton Archipelago. Suggesting the higher the return numbers of the Parent population, the higher the lice levels on corresponding juvenile offspring of pink salmon during their outmigration but there is no correlation with lice levels of on the juvenile salmon and their subsequent return levels as adults (i.e. population survival rate).
- 6.13.5 Peacock *et al.* (2013) suggested that treating farmed fish for sea lice in winter and following the current threshold criteria lead to lower lice abundance on out-migrating juvenile wild pink and chum salmon.
- 6.13.6 Three-spine stickleback, a very abundant nearshore species in British Columbia have been found to host *L. salmonis* to pre-adult stage (Jones *et al.* 2006a; Jones & Prosperi-Porta 2011)
- 6.13.7 Pert *et al.* (2009) suggested successful settlement and feeding on non-salmonids allowed *L. salmonis* to use other species as peripatetic (or paratenic/transport hosts) to improve survival and to aid dispersion until a salmonid host is encountered.

6.13.8 Many non-salmonids are commonly known to host *C. clemensi*, particularly Pacific herring and three-spine stickleback, and may act as year-round reservoirs for this species of louse.

7 SEA LICE ON FARMED PACIFIC SALMON IN BRITISH COLUMBIA

- 7.1 Both Chinook and coho salmon are farmed in British Columbia, although at a far smaller scale than Atlantic salmon
- 7.2 Sea lice assessment and reporting requirements on farmed Pacific salmon are less stringent than for farmed Atlantic salmon.
 - 7.2.1 Assessments are less frequent and carried out on fewer fish.
- 7.3 Saksida *et al.* (2006) examined the sea lice data collected from farmed Pacific salmon.
 - 7.3.1 During the spring, when lice on the farms were to be maintained below three motile *L. salmonis*, the mean abundance reported on farms with Pacific salmon was 0.7.
 - 7.3.2 Even without treatment, lice levels on farmed Pacific salmon were maintained at levels equal to or below those observed on farmed Atlantic salmon.
- 7.4 Similarly, Ho & Nagasawa (2001) reported that coho salmon farmed in Japan had substantially lower sea lice levels than farmed rainbow trout.

8 SEA LICE ON FARMED ATLANTIC SALMON IN BRITISH COLUMBIA

- 8.1 Both *L. salmonis* and *C. clemensi* have been reported on farmed Atlantic salmon in British Columbia
- 8.2 *L. salmonis* levels on farmed Atlantic salmon tend to fluctuate both temporally and spatially.
 - 8.2.1 Levels generally rise as time spent in sea water increases.
 - 8.2.2 This trend was reported in both wild and cultured salmon and is likely attributable to increased length of exposure (Nagasawa 1985; Bron *et al.* 1991; Tully & Nolan 2002; Revie *et al.* 2002b; Heuch *et al.* 2003; Trudel *et al.* 2007).
 - 8.2.3 Saksida *et al.* (2006) reported that levels of *L. salmonis* on Atlantic salmon after more than one year in sea water were 2.5 times higher than those on salmon having spent less than one year in sea water.
 - 8.2.4 The rate of increase of motile *L. salmonis* on farmed salmon in British Columbia was calculated at 2% per month (Saksida *et al.* 2007b).
- 8.3 Seasonal variation of *L. salmonis* is found on farmed salmon
 - 8.3.1 With very few exceptions, *L. salmonis* levels increase in the autumn on farmed Atlantic salmon in British Columbia (Saksida *et al.* 2006, 2007a, b).
 - 8.3.2 The lowest sea lice levels are most frequently reported in the summer. Beamish *et al.* (2006) reported that, in one region, prevalence of sea lice infected farmed Atlantic salmon ranged from 85% in February to 46% in August, and that the intensity of all lice stages on fish was highest in February (21 lice per fish) and lowest in July (3.3 lice per fish).
 - 8.3.3 Orr (2007) looked at gravid female lice levels to estimate egg production from selected farms located in the Broughton Archipelago during 2003/4. He estimated that maximum egg production occurred during November and December and that by January/February egg production was reduced by 50%. By March/April, egg production was down to 6% of the maximum estimated levels.
- 8.4 The increase in lice abundance on farmed salmon in the autumn is associated with the return of adult Pacific salmon to their natal rivers (Saksida *et al.* 2006, 2007a; Beamish *et al.* 2005; Marty *et al.* 2010).
 - 8.4.1 Direct transfer of motile stages has been reported to occur in situations where host densities are high, such as within salmon farms in Europe (Ritchie 1997; Tully & Nolan 2002) and from wild to farmed salmonids in Japan (Ho & Nagasawa 2001).

- 8.5 There is considerable variation in lice abundance between the fish health zones assigned by the government.
- 8.5.1 It has been suggested that the variation in lice abundance between the different farming regions may be related both to the species of wild salmon found in a zone and to their respective abundances (Saksida *et al.* 2006; Jones *et al.* 2006a).
 - 8.5.2 Another source of variation in lice abundance between the different farming regions may be that *L. salmonis* in the Pacific Ocean have been reported on non-salmonid hosts, such as the three-spine stickleback (Jones *et al.* 2006a). The role that these alternate species play in the natural infestation patterns of sea lice on wild and farmed salmon has not been determined as yet.
- 8.6 Observed regional differences may be linked to environmental factors including differences in temperature and salinity, or to local hydrography (Jones *et al.* 2006a). For example, regions with the highest salinity reported the highest sea lice abundance levels (Saksida *et al.* 2006, 2007a, Elmoslemany *et al.* 2015).
- 8.7 Laboratory studies have confirmed associations of environmental factors and lice abundance and in British Columbia; there are differences in environmental factors between salmon farming regions or zones.
- 8.7.1 Changes in salinity and temperature have been reported to affect *L. salmonis* survival and growth rates. Johnson and Albright (1991b) reported that, at salinities of 20 and 25mg/L, the majority of active nauplii died at the copepodid moult stage. Salinity of 30mg/L was required to obtain active copepodids.
 - 8.7.2 Salinity patterns vary considerably among the different BC regions: for instance, both the west coast region as well as the Broughton region show annual variation in surface (0-1 m) salinity with the seasons of lowest salinity being reverse to one another.
 - 8.7.3 Farms on the west coast of Vancouver Island report lowest levels of salinity in the winter and highest in the summer with a mean difference of 4mg/L (23-27mg/L) (Saksida *et al.* 2006). It has been proposed that the variation may be associated with precipitation, which is especially high during the fall and winter.
 - 8.7.4 Conversely, farms situated in the Broughton Archipelago report highest salinity levels in the winter and lowest in the summer with mean differences of almost 6mg/L reported (range 29-23mg/L)(Saksida *et al.* 2006). The freshwater run-off from snowmelt, which occurs in the summer, reduces surface salinity (Foreman *et al.* 2006; Saksida *et al.* 2006, 2007a, b; Beamish *et al.* 2006).

- 8.7.5 Saksida *et al.* (2007b) used a generalized linear model to assess factors associated with *L. salmonis* abundance in the Broughton Archipelago. Several factors such as salmon age, farm location and time of year were found to be significantly associated with abundance -salinity was not. However, this dataset was relatively small containing information collected over 3 years (2003-2005).
- 8.8 There is less inter-annual variation in the other farming regions even though there are differences in the average salinity values between regions.
- 8.8.1 For instance, the Sunshine Coast farms report annual salinity of about 23 mg/L, while the other regions report about 30 mg/L (Saksida *et al.* 2006).
- 8.8.2 The Sunshine Coast (zone 3.1), which is the southernmost farming region, reported the lowest sea lice level on a consistent basis with mean monthly motile levels frequently below one *L. salmonis* per fish without the use of therapeutants.
- 8.8.3 Consequently, the requirement for monthly reporting in the region was discontinued in 2006. Even so, the government continued to include these farms in the audit program (Saksida *et al.* 2006). The farms in the zone voluntarily started reporting into the database in 2010.
- 8.9 There were few differences observed in the water temperature profiles of the different BC regions. Sea temperatures (at 5 m) were higher in the summer than the winter months for each region.
- 8.10 Saksida *et al.* (2006) observed that water temperature did not appear to influence sea lice levels in salmon farming areas of British Columbia.
- 8.11 During the summer, when water temperatures were the warmest and the development of *L. salmonis* would be expected to be greatest, the abundance levels of lice in all zones was lower than in the winter (Saksida *et al.* 2006).
- 8.12 *C. clemensi* tends to be the less common (often by many numerical factors) sea louse species occurring on farmed Atlantic salmon.
- 8.13 *C. clemensi* abundance levels are higher in younger farmed salmon populations.
- 8.13.1 These findings are similar to reports of infestation with *C. elongatus* in Scotland where higher abundance levels were seen in younger salmon populations but differ in that the authors noted consistent levels from year to year (Revie *et al.* 2002a; McKenzie *et al.* 2004).
- 8.14 *C. clemensi* levels do show inter-annual variation though there did not appear to be consistent inter-seasonal variation (Saksida *et al.* 2007a).
- 8.15 Regional differences in abundance levels of *C. clemensi* between farming regions have been observed.

9 HYDROGRAPHIC EFFECTS ON SEA LICE ABUNDANCE

- 9.1 There are significant differences in the primary hydrographic transport mechanisms among the different farming regions in British Columbia.
- 9.2 The primary hydrographic transport mechanisms in the Broughton Archipelago are estuarine flows resulting from considerable river and glacier melt runoff and wind (Foreman *et al.* 2006).
- 9.3 These influences were particularly strong in the inlets of the region especially during the summer months when river flow was at its maximum. Wind driven circulation likely plays a significant role in sea lice dispersion (Asplin *et al.* 1999; Murray & Gillibrand 2006).
- 9.4 In contrast, the primary hydrographic transport mechanism in the Discovery Islands is tidal with little wind effect (Foreman *et al.* 2012).
- 9.5 The significance of these factors around the salmon farms in British Columbia is still not well understood (Rees *et al.* 2015).

10 TREATMENTS FOR SEA LICE IN BRITISH COLUMBIA

10.1 SLICE® (emamectin benzoate) became available to veterinarians under special permit, called an emergency drug release or EDR, obtained from Health Canada in December 2009.

10.1.1 It became the only therapeutic used for sea lice treatment in British Columbia.

10.1.2 SLICE® gained full registration approval in July 2009 with a recommended withdrawal period of zero days, though the industry continues to apply longer withdrawal periods.

10.2 SLICE® usage in British Columbia

10.2.1 The level of treatment frequency in BC is lower than levels reported in any other national or international salmon farming jurisdictions (Johnson *et al.* 2004).

10.2.2 There is very little evidence to suggest that any of the treatments were being provided in response to health concerns in the farmed salmon.

10.2.3 Almost 75% of SLICE® treatments occurred in populations of Atlantic salmon during their second year in seawater between October and March (Saksida *et al.* 2007a, 2010).

10.2.4 Sea lice levels remain lower than pre-treatment levels for 3-5 months following a SLICE® treatment (Saksida *et al.* 2007a, 2010).

10.2.5 However, an immediate concern for the BC salmon farming industry continues to be the inherent limitation of having only one sea lice treatment product available for use.

10.2.6 This differs from other agricultural industries which utilize integrated pest management, a rotation of treatments, to prevent or delay development of resistance in a pathogen.

10.3 Frequency of SLICE® usage in British Columbia

10.3.1 There has been an increase in use of SLICE® since the introduction of the threshold limits with quantities in 2005 reporting levels over 2.5 times greater than levels that existed prior to implementation of the BC Sea Lice Management Strategy in 2003.

10.3.2 Peak use of SLICE occurred in 2005, 2010 and 2011 (~0.26 g/ metric ton (MT) of salmon produced). Usage other times as been at or below 0.2 g/ MT.

10.3.3 The total number of SLICE® treatments for Atlantic salmon ranged from zero to three per production cycle (i.e. smolt entry to harvest) (Saksida *et al.* 2006, 2007a).

10.3.4 Additional data reported in Saksida *et al.* (2010) suggest that frequency of treatment did not change in the first five years since the establishment of the maximum threshold levels.

10.4 SLICE® Efficacy

- 10.4.1 Concerns regarding emamectin benzoate treatment failures, reduced sensitivity and/or potential resistance have been confirmed in Scotland, Ireland, Chile and Norway (Lees *et al.* 2008a, b; O'Donohoe *et al.* 2008; Bravo *et al.* 2008; Aaen *et al.* 2015).
- 10.4.2 Lees *et al.* (2008a, b) analyzed abundance data from Atlantic salmon farms in Scotland between 2002 and 2006 and found that not all treatments were effective; evidence of reduced efficacy over time existed. Similar work was carried out in eastern Canada a few years subsequent to this original work with almost the same patterns of reduced efficacy being reported for farms in that region (Jones *et al.* 2012).
- 10.4.3 Saksida *et al.* (2010) conducted a similar analysis with data collected from farms in British Columbia from 2003 to 2008 and found that there has been no apparent change in the efficacy of the emamectin benzoate's duration of effect. The study found one month (26-34 days) post-treatment lice levels had fallen to below 20% of pre-treatment levels and remained at or below 10% of pre-treatment levels for at least month - the time-period assessed.
- 10.4.4 Lees *et al.* (2008a) defined an "effective" treatment in Scotland as a treatment where the abundance of motile *L. salmonis* fell to less than 40% of their pre-treatment level at some point in the 13 weeks post-treatment.
- 10.4.5 Based on this definition, all of the treatments evaluated in British Columbia clearly fulfilled the criterion of being effective, with levels by 13 weeks post-treatment remaining at or below 10% of pre-treatment levels.
- 10.4.6 Treatment efficacy and EMB bioassays also suggested that sea lice continued to be susceptible to the product (Saksida *et al.* 2010, 2013), although regional differences are seen.
- 10.4.7 A recent modelling study has demonstrated that the presence of a large un-treated 'refugia' of wild fish should indeed likely retard the development of tolerance within sea lice populations (McEwan *et al.* 2015). However, increasing the number of treatments per cycle, one consequence of adopting a reduced sea lice threshold, is one of the key drivers of selection for resistance.
- 10.4.8 There is evidence to suggest that tolerance can build even after 3 treatments, and more rapidly in adult male than female sea lice. This may be because males are more motile – capable of more easily swimming off the host and reattaching than females. Alternatively, males may be hardier as they need to expend less energy in reproduction (McEwan *et al.* 2015).

- 10.4.9 Evidence of tolerance has now been observed and as a consequence hydrogen peroxide bath treatments. These treatments are available in some areas of BC under an Emergency Registration from the Pest Management Regulation Agency (PMRA); hydrogen peroxide has been used four times in British Columbia (in 2014 and 2015) and is found to successfully reduce sea lice.
- 10.4.10 This exemplifies the need a re-evaluate of the current regulations and ensure more prudent use of treatment products.

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Jones, Simon

From: Chamberlain, Jon
Sent: Wednesday, January 11, 2017 1:52 PM
To: Taylor, Nathan; Chandler, Peter; Jones, Simon; Choi, Shirley; Calla, Karen; Lavigne, Lauren; McNabb, Melanie
Cc: Ross, Andrew
Subject: Sea lice speaking notes
Attachments: Speaking notes on Sea Lice Management for Director AMD at meeting with C....docx

Follow Up Flag: Follow up
Flag Status: Flagged

All –

During the preparatory conference call last week we committed to sharing the sea lice speaking points for the CRWG meeting – please find attached. Note that these are a blend of multiple previous media lines and statements.

Thanks

JC

Speaking notes on Sea Lice Management for Director AMD at meeting with CRWG January 12 2017.

DFO management of sea lice in British Columbia

- The objective of Fisheries and Oceans Canada's sea lice monitoring program is to
 - ensure that licence holders are complying with sea lice management conditions of licence and
 - ensure that risks associated with sea lice transfer between wild and farmed fish is minimized during the out-migration period of March to June, when salmon smolts are most vulnerable.
- Aquaculture conditions of licence require operators to
 - regularly monitor and assess sea lice numbers on farmed fish and
 - take action within 15 calendar days (March to June; 30 days for the rest of the year) to reduce lice numbers when counts indicate the presence of more than an average of three motile lice per fish (*Lepeophtheirus* species).
- DFO assesses compliance based on the licence holder's adherence to the conditions of licence.
- On-farm abundance above the three motile species threshold does not, in itself, constitute non-compliance.

Treatment strategy and high abundance levels in fall

- In autumn, adult wild salmon return to their spawning grounds. During this period, these fish carry high numbers of sea lice, which can infect farmed salmon.
- To avoid unnecessary or over-treatment, the best management practice is to wait until the wild migration period is complete before performing any direct sea lice management measures on farmed salmon.

Efficacy of SLICE

- SLICE continues to be an effective treatment for sea lice at aquaculture facilities in the Broughton Archipelago.
- There are well established methodologies and protocols to quantify the effectiveness of therapeutants and to determine when resistance has developed within target populations. Companies continue to assess the sensitivity of sea lice to SLICE in the lab.
- Any reduction in effectiveness of the drug is not necessarily an indication of resistance.

Monitoring sea lice on wild salmon

- Sea lice are naturally occurring parasites that reside on the bodies of both wild and farmed fish.
- Monitoring of sea lice levels on juvenile salmon only provides information on the wild salmon being assessed, not on the origin of the sea lice or any connection to nearby salmon farms. As such, DFO does not collect information on sea lice abundance on wild juvenile salmon.
- Research on the association of sea lice levels at marine finfish sites and nearby wild juvenile salmon populations has been ongoing for many years. It does not appear that consensus will be reached on the precise risk posed by farm-derived sea lice on wild juvenile salmon.
- DFO assesses potential risks to wild stocks by requiring monitoring and auditing of on-farm sea lice levels through conditions of licence.

On farm sea lice reporting on DFO website

- Industry sea lice data are posted up to September 2016
- These data are now updated monthly and available as a downloadable spreadsheet
- DFO sea lice audit reports are posted up to September 2016
- These data are updated quarterly and available as a downloadable spreadsheet
- Data for fall 2016 will be posted on the following timeline
- PLEASE INSERT SEALICE POSTING TIMELINE HERE

Integrated Pest Management

- DFO sees an integrated long-term strategy for managing sea lice is important to the sustainability of the aquaculture industry and the ecosystem within which it operates.
- DFO's sea lice management approach is to ensure that risks associated with the transfer of sea lice from farmed to wild fish is minimized.
- Over the last year, DFO and industry have developed a review of IPM approaches for aquaculture. This reference document should be completed in the coming months.
- We see that the information will be useful in supporting discussions on sea lice management and IPM with all interested parties.

Specific Conditions of Licence text for reference

*6.4 Starting March 1, 2017, the licence holder must conduct annual sampling between March 1 and June 30 for the term set out in this licence. The licence holder cultivating Atlantic salmon and trout must carry out a sea lice abundance assessment every two weeks, at minimum, for fish held in containment structures for more than 30 calendar days. Where data collected in Appendix VI-A indicates the sea lice abundance threshold of three motile *Lepeophtheirus salmonis* has been exceeded, the licence holder must:*

- (a) within 15 calendar days of the discovery, implement a plan which will reduce the absolute sea lice inventory within the containment structure array; and*
- (b) notify the Department as per section 7.1 and 7.3.*

*6.5 Starting July 1, 2016, the licence holder must conduct sampling annually between July 1 and February 28 for the term set out in this licence. The licence holder cultivating Atlantic salmon and trout must carry out a sea lice abundance assessment once every month for fish held in containment structures for more than 30 calendar days. Where data collected in Appendix VI-A indicates the sea lice abundance threshold of three motile *Lepeophtheirus salmonis* has been exceeded, the licence holder must:*

- (a) increase monitoring to at least once every two weeks;*
- (b) within 30 calendar days of the first discovery, provide a plan to address the exceedance to the Department, for its considered response; and*
- (c) notify the Department as per section 7.1.*

Paylor, Adrienne

From: Paylor, Adrienne
Sent: February-01-17 8:17 AM
To: Sonja Saksida [REDACTED]
Subject: FW: sea lice notes
Attachments: The differences in the BC form of L salmonis and differences in pathology seen.doc;
CSAS 2015 Johnson and Jones.pdf

This is what Ian sent last night

From: Keith, Ian
Sent: Tuesday, January 31, 2017 10:40 PM
To: Paylor, Adrienne
Subject: FW: sea lice notes

Hi Adrienne,

Since Karen was already gone, I have re-written and re-titled this for you and her. Please destroy what I sent you – I've destroyed mine because I had to correct some mistakes.

This new title respects the SFU meeting i.e. 0.1 adult female threshold in Norway. The document includes other science based answers that influence our policy and threshold, and how our salinity is an important Mother Nature piece in our integrated pest management and how our IPM will differ because of it.

I've also included the CSAS from 2012 that I was Sonja's adjutant for. It is about a dozen pages I think but would likely take less time to read than my 2+ pages because it is so well written.

Ian

Dr. Ian Keith DVM
Field Operations Veterinarian - Pacific Region
Fisheries and Oceans Canada | Pêches et Océans Canada
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Ian.Keith@dfo-mpo.gc.ca

From: Keith, Ian
Sent: Tuesday, January 31, 2017 2:24 PM
To: Paylor, Adrienne
Subject: sea lice notes

Hi Adrienne,

This document although 3 pages, has the 5 points at the end of the 3rd page.

The questions addressed are those you raised yesterday from your notes from Karen's meeting with SFU.

I hope it helps. The simple one I will whip up now.

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Dr. Ian Keith DVM
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Differences between the Pacific form of *L. salmonis* and the Atlantic form and pathology seen

Ian Keith, Jan 2017

There are 5 important bullets at the end of this document. The background for each is described at some length in the text that precedes them. I have begun the document with a pre-amble.

This is intended to present essential differences between the Pacific form of *Lepeophtheirus salmonis* compared with that in the North Atlantic and the factors concerning lice management here compared with those seen in the North Atlantic countries.

This has 5 parts that speak to the differences in BC compared with other regions of the world.

1. The scale of spillover in BC and its influence on lice management
2. The freshwater effects
3. Management consequences of 1&2 and the requirement of management of parasites if farming.
4. The regulatory threshold and comparison with Norway
5. The Pacific form of *Lepeophtheirus salmonis* and difference from the Atlantic form

One: The first is the very important 2005 ACRDP, ***Incorporating the natural cycles of sea lice (*L. salmonis*) production into a management strategy for sustainable aquaculture***. The title points out one of the big difference between salmon farming in BC and the rest of world: the returning fish spillover is the major source of lice on farmed fish, which Simon Jones says is why our sea lice management should be easier than in any other place in the world – any farm-induced effect on the lice population should be overcome by the new genetic recruitment each fall. (I haven't seen the data, but Sonja says that in one year of using hydrogen peroxide instead of SLICE Marine Harvest has been able to change Klemtu lice populations EC50 levels dramatically i.e. from a mean where there wasn't efficacy to a mean where they predict efficacy.)

Two: The other feature of our situation that is different from Eastern Canada, if not the rest of the salmon growing areas of the world, is that the seasonal freshwater effect naturally breaks patent infections i.e. the hatch of lice eggs does not result in the salmon host supporting development of a new generation of lice producing eggs to continue the cycle. This is not true for full salinity sites like Marsh Bay in the Port Hardy area, but it is true for most of the Broughton, Clayoquot and Sechelt sites. This is why there are farms that can be below threshold during outmigration without treatment, and why one SLICE treatment was all that was required to be near zero over the outmigration period (for the farms in Clayoquot and Broughton). There are studies demonstrating effect of low salinity on settlement of the copepodid stage i.e. the free living to the attached stage, and a recent study (Arriagada et al., 2016) showing effects on mobile stages.

Three: Management consequences: These are factors that influence farm management of the parasite, and management of the parasite is necessary because no matter what type of farming one is engaged

in, the native parasites always have to be managed (because of the amplification of the parasite under the unnatural conditions of confinement and density). The mandate of DFO for proper control and management of the fishery, required the effect of spillback to be known irrespective of the farmer's need to control lice burden for production reasons. Jones et al. (2007) found exposed chum to have less weight gain compared with unexposed although he couldn't kill by experimental exposure. However, Jones et al. (2008) found in challenge studies that pink salmon had a susceptibility threshold and in the lab he could kill pink salmon smolts of <0.7g with 7.5 lice/gram. At a population level, Jones and Hargreaves (2009) estimated that in 2005 4.5% of the pink smolts were of susceptible with or above the threshold burden. However, in subsequent years the burden dropped to 0 in 2008 and Marty et al. (2010) could not find farm lice abundance to influence pink salmon productivity (Broughton study).

Four: The regulatory threshold of 0.1 adult female louse during critical periods as used in Norway reflects their reality. There are dams on Norway's major rivers which challenge the preservation of native sea trout and Atlantic salmon stocks in a similar way that dams on the Columbia River system challenge the preservation of native Chinook stocks. Any pathology and stress associated with infestation of their form of *L. salmonis* are exacerbated with the transport to above the dams and so the regulator acts where it can act, at the farm level to influence exposure to lice. Whereas the ratio of wild (adult) to farmed salmon in BC has been suggested to be 1000:1, in Norway the ratio is reversed at 1:1000, so ecologically the situation is not comparable and there has been cryopreservation of sperm for a decade to deal with the declining gene pool, and more recently, embryos. We don't have these challenges and our management thresholds reflect this and to keep levels this low is to elevate risk of SLICE tolerance.

Five: Irrespective of need to manage parasites in farming, there is a genetic difference of the *Lepeophtheirus salmonis* found in the North Pacific: Yazawa R, et al. (2008) EST and mitochondrial DNA sequences support a distinct Pacific form of salmon louse, *Lepeophtheirus salmonis*. (They proposed that the lesser genetic diversity was consistent with introduction of the species from North Atlantic to the Pacific. The level of divergence is consistent with the hypothesis that the Pacific form of *L. salmonis* coevolved with Pacific salmon and the Atlantic form coevolved with the Atlantic salmon independently and coincides with the opening of the Bering Strait.) Fast et al. (2003) demonstrated phenotypic differences between *L. salmonis* removed from Atlantic salmon from the North Atlantic (New Brunswick, NB) and *L. salmonis* removed from Atlantic salmon from the Pacific (BC), showing difference in salmon mucus preferences, expressed as differences in secreted enzyme profiles. The BC louse had a greater response to coho salmon mucus and the NB louse had a great specific enzyme response to Atlantic salmon mucus. Some authors argue that there are sufficient differences between the Pacific form and the Atlantic form of *L. salmonis* to treat them as separate species, and this is helpful to explain what is observed on farms and wild fish, that Atlantic salmon in BC do not exhibit the severe pathology seen in Atlantic salmon farmed in the North Atlantic. The one exception in the literature (Johnson et al., 1996) is the observation of sockeye in the Alberni Inlet that held for an extended period of time with a delay of a fall freshet. These sockeye came into the inlet with *L. salmonis* and under the conditions there were head erosions similar to what are seen in the North Atlantic salmon farms when lice abundance is not controlled.)

Bullets which are the first principles referred to above:

1. Wild mobile lice on returning wild fish, especially the highly motile males, will move likely by pheromone attraction to breed 2nd stage preadult female lice that will result in eggs with reduced tolerance to SLICE or other farm-induced effect. (The reduction of tolerance is based on Norwegian data and supports a polygenic rather than single gene resistance mechanism.) Mobile female lice are less apt to move but can and would be bringing new genes to the farm population. Eggs deposited from gravid females on the wild fish will hatch, introducing new genetic material to the population in and around the farm.
2. The free-swimming nauplius that hatches from a louse embryo has several moults before metamorphizing into the copepodid that is the infective stage of the louse. Successful settlement of the copepodid and attachment to a host, either salmon or stickleback, requires sufficiently high salinity. Sutherland et al. (2012) found higher stress gene expression at 27 parts per thousand compared with 30ppt. All settlement studies have been performed on the North Atlantic form of *L. salmonis*, but given that stress is expressed at 27ppt in the Pacific form, the findings that survival of the copepodid stage is severely affected by short term salinities below 29 parts per thousand in the Atlantic form (Bricknell et al., 2006) to be conservative it should be said that settlement requires higher salinity i.e. 27ppt=<. In addition, Arriagada et al. (2016) found that salinity had an effect on mobile stages of sea lice population dynamics in BC, which would be in addition to the predicted effects on settlement. These detrimental effects were found in the pre-adult stages of the louse, and potentially, on fecundity.
3. Since salmon are non-sympatric i.e. the adults are gone before the young emerge, spillback of lice from the farmed fish is recognised as a risk that has to be understood and managed. With the different species returning to river systems at different times, the same and different species of smolts outmigration at different times, the extent of lice egg hatch times from the returning salmon, and resident yearling coho and Chinook and stickleback that can be host to the lice between the adults spawning and smolts entering the sea, non-sympatric Pacific salmon does not mean that there aren't means of carrying pests from one generation to the next, that the natural life cycle of sea lice includes passage of infestation. Based on the performance to date it suggests that the lice management of farms for the decade after 2004 (the data in these reviews) appears to be been a success.
4. The degree of spillback represented by the intent of the sea lice policy of minimizing abundance during outmigration and a regulatory threshold of 3 motile threshold appears to have been successful, excepting in the anomalous years 2004 and 2015. Smolts have species specific susceptible sizes, and to date pink salmon have been the only species that can be killed in experimental challenge below a susceptible size. In the Broughton, the year to year variation in prevalence of lice in pink salmon smolts can be explained by the abundance of female lice on farmed fish; however, the abundance of female lice on farmed fish are predicted by the size of the pink salmon run in the previous fall (Marty et al., 2010) and the productivity of the pink fishery isn't negatively associated with the abundance of lice on the farms.

5. The Pacific form of *Lepeophtheirus salmonis* does not cause the pathology in Atlantic salmon seen with the Atlantic form, and genetic and phenotypic differences between the Pacific form and the Atlantic form have been demonstrated for partial explanation.

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Canadian Science Advisory Secretariat (CSAS)

Research Document 2014/019

Pacific Region

Biology of sea lice, *Lepeophtheirus salmonis* and *Caligus* spp., in western and eastern Canada

Simon Jones and Stewart Johnson

Pacific Biological Station
Fisheries and Oceans Canada
3190 Hammond Bay Road
Nanaimo, British Columbia V6T 6N7

March 2015

Canada

Pages 56 to / à 77
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68(a)

of the Access to Information Act
de la Loi sur l'accès à l'information

Sandberg, Krista

From: Sandberg, Krista
Sent: January-20-17 9:29 AM
To: Keith, Ian
Subject: RE: Steamer/Esperanza sea lice reports

Hi Ian,

I'm sorry I mixed up my farms again. I did not mean Mahatta East and West I meant Muchalat North and South that had the zero lice counts....

I will update the comments and be ready for the call on Monday.

Krista.

Krista Sandberg

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cellular: [REDACTED]

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From: Keith, Ian
Sent: Thursday, January 19, 2017 11:19 PM
To: Sandberg, Krista
Cc: Paylor, Adrienne
Subject: FW: Steamer/Esperanza sea lice reports

Hi Krista,

I spoke [REDACTED] and have answers to all your questions.

1. Duncan: [REDACTED] said what I recalled from Kerra. One circle had more than one sea lion inside the pen. The situation is resolved now because all fish in the pen have been eaten. No tears in the net but entire fish were consumed – Howie's experience has been sucking of the fish through the mesh where heads are recovered through carcass recovery. As suggested in licence conditions, there are safety issues, that Howie had stories from Clayoquot where the sea lions aggressively challenge humans that would venture out onto the catwalks of catamaran or square cage systems. The FH crew will be going to Duncan, or including Duncan in their active site list for fish health audits and sea lice now that the affected cage is empty. While the sea lions were in the affected cage though, fish in all cages would have been stressed and seining for lice counts would have ill-advised because of risk of breaking with infectious disease. SLICE will be leaving Vancouver on the 9 February barge. (They are permitted to use peroxide but this would require loosening of anchoring but this group of sea lions will be looking for new opportunities.)
2. Mahatta East and Mahatta West: [REDACTED] said that these farms don't yet have fish but Mahatta E will soon be stocked with a split from Monday Rocks or Koskimo. [REDACTED] said that Monday Rocks does have some salinity influence from a creek behind the site, and Howie confirmed that earlier this week when they were there, that the snow melt and water made the water brown. [REDACTED] said that the salinity was 27ppt while Koskimo was 31ppt, and that Koskimo was always full salinity. As expected the most recent count found some lice at Koskimo. With single year class and fallow since June/July, they aren't surprised at no lice for the first couple of months.
3. Althorpe: We were right to give them the benefit of the doubt. This site they don't have a pesticide use permit for and SLICE was on an early January barge, 5 January I think she said, which means that if they haven't started treatment yet this will commence in a couple of days. She is delivering on a 30 day post threshold action. She will have [REDACTED] send the plan; you and I have to decide whether we require the re-submission of the

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December report to correct that "no action necessary" should be corrected. (My speculation was correct, that 2 cages came from Shelter Bay and these fish had been treated with SLICE; the single pen 5 December count was from Wicklow that hadn't been treated with SLICE so had chalimus.)

4. My comment about including pen level treatment information in fish health events, and how we could receive some backlash, you and I had not talked about. We had decided that I would contact Grieg to get them to change the Steamer Oct and November reports. I said I would call [REDACTED] today and I didn't but will Friday. Since I shared with you that I would ask [REDACTED] to submit the pen level treatment information in her fish health events notifications, I will update you that she was fine with it. I didn't ask for it to be retro-active, but asked that she do this going forward.

If you are able to adjust comments and if we can touch base tomorrow. Adrienne has a meeting with Karen Monday that will go over the revised reports. I think that you and I and Sonja are also in the phone meeting. Adrienne can prime us for the call but I think there will be some answering of their questions but also an opportunity for you to identify snags that are apt to come up, get Sonja to weigh in to inform. On the phone I also want to discuss Steamer/Esperanza and what to do if they don't have a pesticide use permit; last year they had a pesticide use permit but said they were harvesting in Nootka when they weren't.

Thanks

From: Keith, Ian
Sent: January-19-17 1:51 PM
To: Sandberg, Krista; Paylor, Adrienne
Subject: RE: Steamer/Esperanza sea lice reports

From: Sandberg, Krista
Sent: Thursday, January 19, 2017 10:07 AM
To: Paylor, Adrienne
Cc: Keith, Ian
Subject: RE: Steamer/Esperanza sea lice reports

Hi Adrienne,

As per the email below, we still need to discuss the comment for Steamer/Esperanza for the November sea lice report which is otherwise ready to go: X:\1. PUBLIC REPORTING\Sea Lice\Monthly Farm Level (A)\2016\SL Report A - NOVEMBER 2016.xlsx

Also, the December report is also now ready for your review:

X:\1. PUBLIC REPORTING\Sea Lice\Monthly Farm Level (A)\2016\SL Report A - DECEMBER 2016.xlsx

There are a lot of exceedances etc. with the December report, so I think it would also be a good idea for Ian to have a look at this one in case he may have any other information that I am unaware of. I've already spoke to him about a couple things. A few things main to consider that I noted:

- As with November, the Steamer/Esperanza issue. Still high counts. Status of alternative treatment? The one month advertisement for the pesticide use permit ended Sunday but First Nations response was not progressing



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March Klaver said that this intent to have minimal abundance during outmigration can only be exercised for amendments, [REDACTED]

- Althorpe – they exceeded at the end of December but have not provided any treatment plan – Ian following up. I will ask them for their area based management plan for Sunderland Channel as well as correction of the report.
- Duncan – no counts due to “weather and predator issues”. This is a very exposed site but I’m surprised that they were not able to do any counts at all due to weather, and if they have a sea lion in the pen(s), how many? This site has polar circles so do they have sea lions in all the pens? I doubt it, so why couldn’t they do lice sampling in the other pens? Regardless, nothing was counted so we need to come up with a comment for the public report. I have to find out more detail that Kerra knew, and the Worksafe provisions have to be understood and may influence what is said in the Comment.
- Mahatta East and Mahatta West – counts of zero all around. Not one louse. Ian, is this plausible? [REDACTED]
[REDACTED] I know there is a lot of fresh water there but to have absolutely NO lice at either site??? The crew have been here for fish health but not SL. It is plausible however; the difference between Monday Rocks/Koskimo and the Mahattas is terrific in terms of salinity. They wanted to stock after the salmon runs had passed – spillover of motiles from the wild fish would be possible at lower salinities but the copepodids from the hatch from any lice eggs deposited would not settle at the low salinities. The Mahatta River would have been flowing well this fall.
- I noticed a lot of facilities that didn’t actually exceed in December have plans for SLICE treatment in January – Cermaq sites in zones 3.2 and 3.3 in particular. Ian, is this an area management approach? Do you think we should add this to the comments? I like to recognise area management and management in Okisollo Channel requires coordination between the 3 companies. I have to look at their approach in Broughton but Sonja did a paper that would inform assessment of their plan there.

Hopefully we can touch base next week when you’re back from Ottawa. [REDACTED]

Krista.

Krista Sandberg

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From: Sandberg, Krista

Sent: Thursday, January 12, 2017 1:52 PM

To: Paylor, Adrienne (Adrienne.Paylor@dfo-mpo.gc.ca)

Cc: 'Keith, Ian'

Subject: Steamer/Esperanza sea lice reports

Hi Adrienne,

I just spoke with Ian about the Steamer/Esperanza sea lice issue. They both treated with Slice in September, and have reported “treatment ongoing” in both the October and November submissions, with the treatment date of September 13/14. I don’t really think that it’s an issue of misreporting, more that they were giving us the data and it is up to us to interpret that. I took their report of “treatment ongoing” at face value as I knew that there were plans to initiate hydrogen peroxide treatments and that they were just going through the licence application process. If Karen wants the comments in the October and November reports for these facilities to be less generic, then Ian and I suggest:

Bi-weekly counts; Alternative management action planned.

Do you want to run this by Karen and see if she feels that is detailed enough?

Krista Sandberg

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Keith, Ian

From: Keith, Ian
Sent: January-20-17 11:43 PM
To: Paylor, Adrienne
Subject: RE: Sonja and Monday's call with Karen

[REDACTED] I hope you have the time to consider this and discuss with Sonja before our phone meeting.

With Karen's momentum (Marsh decision), Sonja still being at our elbows, and willingness for some changes that you referred to, we may be in a prime position to correct what Sonja and I have repeatedly said is the most serious challenge to health we have. This doesn't require change in licence, it requires change in authorized production. (March has shut me down saying that peak biomass won't change. [REDACTED] March cites legislation to say we can't change licence conditions but doesn't cite legislation to say we can't change authorized production.)

I've used Sonja's professional language – I would phase it differently, that Karen has to be warned that within pen fish size variation is the greatest risk we have for sustainability of BC salmon aquaculture, because with farming you have native parasite infestation and bacterial disease that have to be controlled. You can't inject every fish; you have to be able to use medicated feed. With such size variation you can't get therapeutic doses in all your fish and sublethal levels of SLICE and antibiotics are an efficient means of selecting for resistance. Jon Chamberlain's told me that for the sea lice meeting with the ENGOs last week, his solution for reducing sea lice abundance was to make more drugs available: Sonja and I have responsibility for veterinary oversight of antimicrobials and there is a national framework to address this under new Federal Government regulations which are expected to be implemented by the end of 2017. Jon's suggestion is regressive as resistance will develop to any new drugs because there is promotion of resistance through the change in authorized production that DFO implemented. [REDACTED]
[REDACTED]

You asked last year whether we have evidence of increased tonnage or another factor to account for the 4 fold increase in SRS in Clayoquot. We know it is multifactorial so no, we won't be able to sort it out. However, we have evidence of losing effectiveness of SLICE. Sonja cannot say that having peroxide is going to be a solution; maybe, it buys you some time while you wait for a long period of low salinity.

Sonja without knowing size variation identified underdosing as one of two causes for SLICE tolerance in Klemtu. The same should be predicted will happen for antibiotics. I have a publication of oxytetracycline resistance for atypical furunculosis where there was half dosing of the drug – this has the same effect as underdosing because of size variation.

Karen understands the challenge to ***incorporate the natural cycles of sea lice production into a management strategy for sustainable aquaculture*** (the ACRDP that Dick Beamish and Sonja worked on in 2005). The intent is to minimize abundance during outmigration, and to do this without having lice develop resistance to SLICE. The answer is strategically timed treatment but having uniformly sized fish is necessary which is not the case so I am conflicted.

- I am to judge the veterinary management of lice abundance that will minimize abundance the vulnerable population of wild salmon – pinks under 0.7 g, as I did while with the province
 - How can DFO Science not share with their health management counterparts that they have data indicating that sockeye are the most susceptible species of Pacific salmon
 - [REDACTED]
 - How interpretative do we want the comments in the SL public reporting. Strategically timed treatments are going to be based on run times and year on year refinement. Timing of winter treatment we are

conflicted with: licence conditions say to minimize for outmigration, but if a dry winter and burdens are high, then SLICE treatment would be more appropriate around January 1. The regulation promotes treatment at the middle of February so that there is metaphylactic effect i.e. there will be therapeutic levels present in the fish to stop infestation from the hatch that will occur in March and early April.

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From: Paylor, Adrienne
Sent: Friday, January 20, 2017 2:32 PM
To: Keith, Ian
Subject: RE: Sonja and Monday's call with Karen

Thanks Ian,

The call with Karen on Monday is just an opportunity for Karen to ask any questions she has about the sea lice numbers in the public report for her own understanding and then we will decide if any further explanations are appropriate for the comments column in the public version. Sonja is certainly welcome (always) to join if she has time or interest. I have also invited Krista to join in case we need to her to make changes to the report for us. I know you are able to answer any of Karen's questions but I'll invite Sonja as well if you think she would like to be involved. Let me know ☺ As for the MTA I did speak to Karen about it yesterday and she confirmed that she and Nathan are still working on it so if there are any changes or updates we just need to let her know otherwise we are waiting on them.

Thx Adrienne

From: Keith, Ian
Sent: Friday, January 20, 2017 1:53 PM
To: Paylor, Adrienne
Subject: Sonja and Monday's call with Karen

Hi Adrienne,

I chatted with Sonja this morning and mentioned the call with Karen on Monday. I said that we would be going over comments in the sea lice report. But when we met yesterday and you said you would ask for a phone meeting with Karen regarding the public report, I think what triggered it was my agreeing with you that commenting on the regulatory perspective required biological understanding. I told Sonja that I would ask if you would be extending the call to include her, but this would depend upon what specifically you were going to resolve with the call. If it was just with regard to comments, then I think I have the experience and knowledge to propose and defend but if the discussion were to be broader then you know that I can disagree with Sonja but accept her advice as wise. So don't exclude her on my account.

By the way, I said that Ian Gardner, Sonja and I would be talking about the MTA during our call January 16 and you gave me instruction as you were walking out the door to have Sonja contact Karen with any update regarding the MTA given

s.16(2)(c)

s.19(1)

s.21(1)(b)

that she and Nathan were managing this. Ian, Sonja and I didn't talk about the MTA so Sonja wouldn't have anything to update Karen with.

This said, we are going to talk about the MTA at noon Monday (with Ian, Raphael and the post-doc epidemiologists).

Ian

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s.16(2)(c)

Sandberg, Krista

From: Sandberg, Krista
Sent: January-20-17 2:13 PM
To: Keith, Ian
Cc: Paylor, Adrienne
Subject: RE: Steamer/Esperanza sea lice reports

Hardwicke's fish were entered in September. They treated on 21-Nov and counts were down to 3.77 by 13-Dec and 0.47 by 27-Dec.

Chancellor and Lees treated on 21-Nov and 20-Nov. December counts were below threshold.

Krista Sandberg

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From: Keith, Ian
Sent: Friday, January 20, 2017 2:01 PM
To: Sandberg, Krista
Cc: Paylor, Adrienne
Subject: FW: Steamer/Esperanza sea lice reports

Missed some

Adrienne had questions about Chancellor Channel farms. Hardwicke was outrageously high numbers in the fall but this was during or just after spill over time and they were harvesting out. Chancellor was also above threshold but SLICE treatment of Chancellor, Lees and Hardwicke will occur as soon as Hardwicke is restocked. I believe the re-stocking has occurred.

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From: Keith, Ian
Sent: Thursday, January 19, 2017 11:19 PM
To: Sandberg, Krista
Cc: Paylor, Adrienne
Subject: FW: Steamer/Esperanza sea lice reports

s.16(2)(c)
s.19(1)

Hi Krista,
I spoke [REDACTED] and have answers to all your questions.

1. Duncan: [REDACTED] said what I recalled from Kerra. One circle had more than one sea lion inside the pen. The situation is resolved now because all fish in the pen have been eaten. No tears in the net but entire fish were consumed – Howie's experience has been sucking of the fish through the mesh where heads are recovered through carcass recovery. As suggested in licence conditions, there are safety issues, that Howie had stories from Clayoquot where the sea lions aggressively challenge humans that would venture out onto the catwalks of catamaran or square cage systems. The FH crew will be going to Duncan, or including Duncan in their active site list for fish health audits and sea lice now that the affected cage is empty. While the sea lions were in the affected cage though, fish in all cages would have been stressed and seining for lice counts would have ill-advised because of risk of breaking with infectious disease.
SLICE will be leaving Vancouver on the 9 February barge. (They are permitted to use peroxide but this would require loosening of anchoring but this group of sea lions will be looking for new opportunities.)
2. Mahatta East and Mahatta West: [REDACTED] said that these farms don't yet have fish but Mahatta E will soon be stocked with a split from Monday Rocks or Koskimo. [REDACTED] said that Monday Rocks does have some salinity influence from a creek behind the site, and Howie confirmed that earlier this week when they were there, that the snow melt and water made the water brown. [REDACTED] said that the salinity was 27ppt while Koskimo was 31ppt, and that Koskimo was always full salinity. As expected the most recent count found some lice at Koskimo. With single year class and fallow since June/July, they aren't surprised at no lice for the first couple of months.
3. Althorpe: We were right to give them the benefit of the doubt. This site they don't have a pesticide use permit for and SLICE was on an early January barge, 5 January I think she said, which means that if they haven't started treatment yet this will commence in a couple of days. She is delivering on a 30 day post threshold action. She will have [REDACTED] send the plan; you and I have to decide whether we require the re-submission of the December report to correct that "no action necessary" should be corrected. (My speculation was correct, that 2 cages came from Shelter Bay and these fish had been treated with SLICE; the single pen 5 December count was from Wicklow that hadn't been treated with SLICE so had chalimus.)
4. My comment about including pen level treatment information in fish health events, and how we could receive some backlash, you and I had not talked about. We had decided that I would contact Grieg to get them to change the Steamer Oct and November reports. I said I would call [REDACTED] today and I didn't but will Friday. Since I shared with you that I would ask [REDACTED] to submit the pen level treatment information in her fish health events notifications, I will update you that she was fine with it. I didn't ask for it to be retro-active, but asked that she do this going forward.

If you are able to adjust comments and if we can touch base tomorrow. Adrienne has a meeting with Karen Monday that will go over the revised reports. I think that you and I and Sonja are also in the phone meeting. Adrienne can prime us for the call but I think there will be some answering of their questions but also an opportunity for you to identify snags that are apt to come up, get Sonja to weigh in to inform. On the phone I also want to discuss Steamer/Esperanza and what to do if they don't have a pesticide use permit; last year they had a pesticide use permit but said they were harvesting in Nootka when they weren't.

Thanks

From: Keith, Ian
Sent: January-19-17 1:51 PM
To: Sandberg, Krista; Paylor, Adrienne
Subject: RE: Steamer/Esperanza sea lice reports

s.19(1)

From: Sandberg, Krista
Sent: Thursday, January 19, 2017 10:07 AM
To: Paylor, Adrienne
Cc: Keith, Ian
Subject: RE: Steamer/Esperanza sea lice reports

Hi Adrienne,

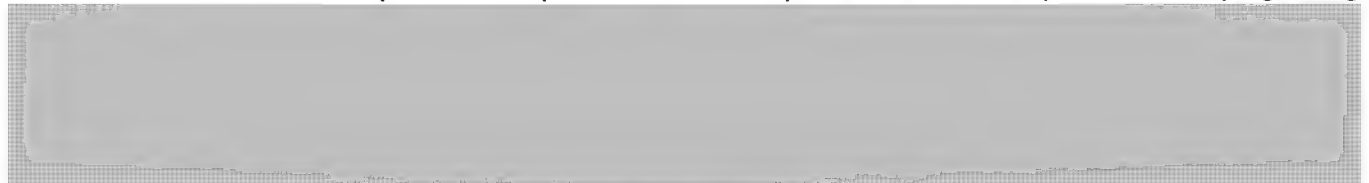
As per the email below, we still need to discuss the comment for Steamer/Esperanza for the November sea lice report which is otherwise ready to go: X:\1. PUBLIC REPORTING\Sea Lice\Monthly Farm Level (A)\2016\SL Report A - NOVEMBER 2016.xlsx

Also, the December report is also now ready for your review:

X:\1. PUBLIC REPORTING\Sea Lice\Monthly Farm Level (A)\2016\SL Report A - DECEMBER 2016.xlsx

There are a lot of exceedances etc. with the December report, so I think it would also be a good idea for Ian to have a look at this one in case he may have any other information that I am unaware of. I've already spoke to him about a couple things. A few things main to consider that I noted:

- As with November, the Steamer/Esperanza issue. Still high counts. Status of alternative treatment? The one month advertisement for the pesticide use permit ended Sunday but First Nations response was not progressing



March Klaver said that this intent to have minimal abundance during outmigration can only be exercised for amendments,

- Althorpe – they exceeded at the end of December but have not provided any treatment plan – Ian following up. I will ask them for their area based management plan for Sunderland Channel as well as correction of the report.
- Duncan – no counts due to “weather and predator issues”. This is a very exposed site but I’m surprised that they were not able to do any counts at all due to weather, and if they have a sea lion in the pen(s), how many? This site has polar circles so do they have sea lions in all the pens? I doubt it, so why couldn’t they do lice sampling in the other pens? Regardless, nothing was counted so we need to come up with a comment for the public report. I have to find out more detail that Kerra knew, and the Worksafe provisions have to be understood and may influence what is said in the Comment.
- Mahatta East and Mahatta West – counts of zero all around. Not one louse. Ian, is this plausible? I know there is a lot of fresh water there but to have absolutely NO lice at either site??? The crew have been here for fish health but not SL. It is plausible however; the difference between Monday Rocks/Koskimo and the Mahattas is terrific in terms of salinity. They wanted to stock after the salmon runs had passed – spillover of motiles from the wild fish would be possible at lower salinities but the copepodids from the hatch from any lice eggs deposited would not settle at the low salinities. The Mahatta River would have been flowing well this fall.
- I noticed a lot of facilities that didn’t actually exceed in December have plans for SLICE treatment in January – Cermaq sites in zones 3.2 and 3.3 in particular. Ian, is this an area management approach? Do you think we should add this to the comments? I like to recognise area management and management in Okisollo Channel requires coordination between the 3 companies. I have to look at their approach in Broughton but Sonja did a paper that would inform assessment of their plan there.

Hopefully we can touch base next week when you’re back from Ottawa.

Krista.

Krista Sandberg

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s.16(2)(c)

s.19(1)

s.21(1)(b)

From: Sandberg, Krista
Sent: Thursday, January 12, 2017 1:52 PM
To: Paylor, Adrienne (Adrienne.Paylor@dfo-mpo.gc.ca)
Cc: 'Keith, Ian'
Subject: Steamer/Esperanza sea lice reports

Hi Adrienne,

I just spoke with Ian about the Steamer/Esperanza sea lice issue. They both treated with Slice in September, and have reported "treatment ongoing" in both the October and November submissions, with the treatment date of September 13/14. I don't really think that it's an issue of misreporting, more that they were giving us the data and it is up to us to interpret that. I took their report of "treatment ongoing" at face value as I knew that there were plans to initiate hydrogen peroxide treatments and that they were just going through the licence application process. If Karen wants the comments in the October and November reports for these facilities to be less generic, then Ian and I suggest:

Bi-weekly counts; Alternative management action planned.

Do you want to run this by Karen and see if she feels that is detailed enough?

Krista Sandberg

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s.16(2)(c)

Sandberg, Krista

From: Sandberg, Krista
Sent: January-24-17 9:46 AM
To: Shaw, Kerra
Subject: FW: Oct and Nov Steamer and Esperanza

Below is what Ian said. Maybe not anything more than what you discussed with him.

Krista Sandberg

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From: Keith, Ian
Sent: Monday, January 23, 2017 5:04 PM
To: Sandberg, Krista
Cc: Paylor, Adrienne
Subject: FW: Oct and Nov Steamer and Esperanza

Recapping our conversation:

Grieg will be sending the corrected Oct and Nov Steamer and Esperanza reports. They are aware that the public reports will say "alternate treatment plans; bi-weekly counts" or whatever language you chose. Marine Harvest is aware that the public report will not say "environmental:" i.e. "an ongoing environmental issue would lead to additional fish stress or harm if handled." I said that we considered the stress on the fish was reason to not add the stress of seining and handling. They are aware that the public report will say "Fish stress due to predator activity." With regard to Duncan, [REDACTED] just called and has a different picture from my understanding of what occurred. Anchoring sounds like it was an issue, as you said, and fish from the 2 end pens were affected, not an isolated pen and obviously the story isn't that a single pen had all fish eaten. [REDACTED] The "divers haven't yet recovered morts from the affected cages," [REDACTED] reported, and what she said is more plausible and what you expected to see. There is a lot of detail missing from the picture that we should know before this report is posted. I chatted with Kerra before she left, [REDACTED] Going forward, there should be condition of licence that could inform us of these events as they are occurring. I would push for this, and a bulletin for sea lice counts could specify that should there be a notification of events preventing counts.

Ian

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s.16(2)(c)
s.19(1)
s.20(1)(b)
s.21(1)(b)

From: Keith, Ian
Sent: Monday, January 23, 2017 3:00 PM

To: Sandberg, Krista
Subject: RE: Oct and Nov Steamer and Esperanza

I hope you didn't think that I misrepresented our discussions, but from my perspective this was an honest representation. Most importantly, you and I are concerned for those farms where lice management does not involve strategically timed SLICE application in the fall. For those farms that rely on a treatment in winter i.e. January, February, there could be hatch in late February and into the spring, from eggs deposited in January that in a dry winter, will result in copepodids settling on outmigrating smolts.

If you'd rather me letting you speak for yourself, I can respect that.

I was pleased with introducing (Dick's title for his 2005 ACRDP), "incorporating the natural cycles of sea lice production into a management strategy for sustainable aquaculture." It is complex, with salinity and new genes from the male lice from wild fish as well as recruitment of new lice influencing the lice population genetic structure being the biggest difference from the ecology of the Atlantic Ocean. It was nice to remind Karen that our *L. salmonis* is only distantly related to the Atlantic Ocean *Lepeophtheirus salmonis*, where 9% of production is lost to sea lice related mortality (in Scotland and Finland, she said on the call).

I'm awaiting a response about Oct and Nov reports. I shared that we would be referring to alternate treatment, and Karen supports us on this.

I'll call now regarding Duncan. (By the way, the crew is doing a SL count at Duncan, as we speak.) I expect they have media lines at the ready.

Ian

From: Sandberg, Krista
Sent: Monday, January 23, 2017 10:46 AM
To: Keith, Ian
Subject: RE: Oct and Nov Steamer and Esperanza

Yes, this was to be part of the discussion for today. I still have not heard if Karen approves of "Alternative Management Action Planned". I haven't changed anything until I know her decision. There was no intention to say that management action was underway when it is not. When these reports were originally drafted we hoped that the H202 would be completed but it has not.

Krista Sandberg

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From: Keith, Ian
Sent: Monday, January 23, 2017 10:38 AM
To: Sandberg, Krista
Subject: Oct and Nov Steamer and Esperanza

Hi Krista,

I see that the public report for Oct and Nov still have Steamer and Esperanza as Management Action Underway. We have already established that management action was in September, confirmed by the company.

We've always reserved Management Action Underway for the month in which the management action occurred, and it is discretionary whether we report it for two months if it carries over two months. The vets report for the management action for only one month, for example, the question of the vet, "Do you want me to report in Mortality by Category report the action to be August or September if I started treatment in August."

I see that the Aquiis template indicates a drop down for action, but there is no list.

So it is conspicuous that you have not corrected Nov and Oct this and I expect the call today will include explanation with discussion of fixes.

Ian

No information has been removed or severed from this page

Keith, Ian

From: Keith, Ian s.19(1)
Sent: January-27-17 2:19 AM s.20(1)(b)
To: Saksida, Sonja s.21(1)(b)
Subject: Esperanza Inlet s.23

Hi there,

You were aware of Grieg of SLICE tolerance at the Esperanza Inlet site, Steamer. Bioassay, 2014, before effective treatment, [REDACTED] There were 3 treatments in the interim. [REDACTED]

[REDACTED] told me today that Marine Harvest cannot give them use of the barge and equipment for the Paramove that they submitted as their plan. (I knew this this morning because Howie said that MHC was using their well boat to control lice levels at Sheep while harvest is going on. (I left a message [REDACTED] asking if there were withdrawal requirements.))

On Monday's call with Karen I ended the call with my concern that Grieg would do just what they've done. If numbers are below in February, you can use harvest in the outmigration period. [REDACTED] said that they were going to harvest some fish to reduce absolute lice inventory ahead of March 1, and are purchasing their own barge which would allow them to treat and harvest during outmigration. I said that I would take his proposal up the chain.

Howie warned me about licence conditions, [REDACTED]
[REDACTED] We all know this but I know there are conservation units of concern (chinook) in Esperanza Inlet that were used to deny Grieg adding chinook to their Esperanza licences in 2012. [REDACTED]

Two science questions. [REDACTED]

IF there is a selected population in the Inlet, then harvest with capturing lice with lice socks and harvest is necessary; Marine Harvest [REDACTED] when skimming the water surface when tarping for peroxide treatment.

The alternate source of the tolerant lice is Nootka; there was evidence of failure June 2015 in the lice data, and when questioned [REDACTED] agreed with my interpretation.

[REDACTED] has lice DNA from Esperanza and Nootka.

2. The fish that went from Esperanza Inlet to Noo-la (Broughton) occurred in April. According to what they sent Krista [REDACTED] on site they said the fish were from Steamer that reported 0.2 mobiles in March and 0.1 mobiles in April. [REDACTED] said that they would be doing a bioassay at Noo-la prior to SLICE treatment but the report came in yesterday, 5.38 abundance with an anticipated commencement of treatment on Tuesday, Jan 31. [REDACTED]

[REDACTED] There were [REDACTED] fish transferred and these were much larger than the others so there will be [REDACTED] fish in these 4 pens.

Ian

s.20(1)(b)

s.21(1)(b)

Keith, Ian

From: Keith, Ian
Sent: January-27-17 1:56 PM
To: Paylor, Adrienne
Subject: FW: Esperanza
Attachments: Esperanza Inlet Jan2017.doc

This letter is in the style suggested by Sonja, although hers, [REDACTED] would read better.

The two pieces that I might include in a letter:
to soften the blow of their reality:

- DFO would meet with MOE, government to government, to ask that hydrogen peroxide be classified as a Schedule II pest control product because of how environmentally benign it is. This can be justified [REDACTED] (Schedule II pest control products do not require permits and without pesticide use permits there can be some confidence that purchasing barges and equipment will not have risk of not being able to use the equipment.)

To remind them of the seriousness of the situation:

- It has come to my attention that fish originating at Steamer Point were transferred to Noo-la in April, that Noo-la abundance reached threshold 25 January, 2017 and that Grieg Seafood will be performing SLICE bioassays on the sea lice from Noo-la imminently. We would be interested in the results of that bioassay, and feel that veterinarians from the three companies meet to discuss the results.

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From: Keith, Ian
Sent: Friday, January 27, 2017 1:30 PM
To: Paylor, Adrienne
Subject: FW: Esperanza

Please note that I just got off the phone [REDACTED] and told him I would call him at the office after your meeting with Karen so that he could gain a few days on harvest i.e. harvest barge, crews, plant readiness..

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s.14
s.16(2)(c)
s.19(1)
s.21(1)(b)

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From: Keith, Ian
Sent: Friday, January 27, 2017 1:28 PM
To: Paylor, Adrienne
Subject: Esperanza

As per our conversation this morning

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s.16(2)(c)



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106-1180 Ironwood Road
Campbell River, BC

It has come to my attention that the plans for Steamer Point and Esperanza sea lice treatment with Paramove 50® (hydrogen peroxide) that you were requiring a pesticide use permit for is exceedingly difficult for you to achieve ahead of March 1.

We agree with your assessment of the SLICE® (emamectin benzoate) bioassay results, another treatment with this drug is contraindicated and would be predicted to fail, and our estimate from the sea lice audit at Steamer Point December 16, 2016, confirms that abundance has exceeded threshold, as reported, and that abundance at Esperanza is also above threshold.

Licence conditions require abundance to be below threshold, 3 mobile lice per fish, by March 1, as reducing absolute lice inventory by harvest as an action for managing sea lice burden is for farms that enter the outmigration period below threshold.

s.19(1)

s.20(1)(b)

Canada



Ensuring Sustainable Fisheries

Paylor, Adrienne

From: Paylor, Adrienne
Sent: February-06-17 1:24 PM
To: Lavigne, Lauren
Subject: FW: Esperanza SL thresholds
Attachments: SLICE tolerance issue.doc; The differences in the BC form of L salmonis and differences in pathology seen.doc

Hi Laruen,

Below are the summary bullets I provided Karen Esperanza & Steamer. We are waiting to hear back from Industry on their plans. Attached are Ian's summaries on SLICE tolerance and the BC threshold as some background in case we need it. I was going to pass these on to Karen but let me know if I should shorten them first?

Adrienne

From: Paylor, Adrienne
Sent: Friday, January 27, 2017 4:54 PM
To: Calla, Karen
Subject: Esperanza SL thresholds

For your conversation [REDACTED]

Our Fish Health Units has advised us of the following:

- On January 15th Grieg reported sea lice counts above threshold for December at Esperanza (12.6) & Steamer (15.4)
- DFO FH conducted an Audit at steamer on Dec 16th with a count of 15.3
- Industry sea lice counts for January will be reported on Feb 15th and a DFO FH audit is planned for Steamer on Feb 20th
- Both farms were above threshold and treated with SLICE in September 2017 which was found to be ineffective.
- Grieg's Vet [REDACTED] provide Ian and Sonja with Bioassays from steamer and tissue residual reports from Steamer & Esperanza indicating a SLICE resistance problem.
- DFO Vet's agree [REDACTED] that it is not advisable to administer another SLICE treatment at this time.
- Grieg's vet had submitted a plan for a hydrogen peroxide bath treatment to lower the numbers below threshold prior to the March 1st outmigration window.
- Grieg's application for a pesticide use permit from MOE has been fulfilled pending First Nations' consultation which is planned for February 3.
- Grieg's Vet [REDACTED] advised Ian yesterday that they are unable to attain the MH barge and equipment to execute this submitted plan.
- DFO plans to send Grieg a formal letter advising them that sea lice abundance needs to be below threshold by March 1, 2017.
- At this point a plan of harvesting-out would appear their only option [REDACTED]

Please call if you require any further details.

Thanks,

Adrienne Paylor

Regional Manager, Aquaculture Environmental Operations
Fisheries and Oceans Canada / Peches et Oceans Canada
Aquaculture Management Division / Gestion de l'aquaculture
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Adrienne.paylor@dfo-mpo.gc.ca

s.19(1)

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SLICE tolerance issue

Feb 2017

Pre-amble: The final or the last two paragraphs are discussion about the SLICE tolerance issue at Steamer and Esperanza. The body describes the most recent literature on SLICE tolerance that includes the Pacific form of *Lepeophtheirus salmonis*.

Definitions:

SLICE “tolerance” is used by Merck the manufacturer. Merck reserve the term “resistance” for those cases where the cause of the tolerance has been identified. The loss of efficacy in the field would be when lice abundance reduction is some threshold target reduction when tissue levels are in the target range of 60 to 100ng/g.

Transcriptomic responses: A molecular biology technique that measures the first steps in protein synthesis i.e. synthesis of messenger RNA from DNA - *transcriptomic* is the adverb referring to RNA transcription. Sutherland et al. (2015) measure how strong the response to stimuli and compare SLICE resistant and sensitive lice.

EC50: The bioassay SLICE concentration where a calculated 50% of lice are killed. An increase in dose necessary to kill predicts reduced efficacy in the field.

Overexpression: Greater than normal production levels of a protein, or the measurable steps preceding synthesis of the protein i.e. transcription and translation.

SLICE toerance

Sutherland et al. (2015) examined specific candidate genes with potential to influence resistance in SLICE resistant and SLICE tolerant *Lepeophtheirus salmonis* from New Brunswick. The baseline expression (transcription) of genes for multiple enzymes with potential involvement in resistance were higher in resistant than sensitive New Brunswick lice (i.e. overexpression in the resistant lice). Lice from BC were compared with the New Brunswick lice included in the study by looking at response to SLICE exposure (as the BC lice at the time of the study, 2009 had no signs of resistance). There was no up-regulation of the mRNA examined (using reverse transcription quantitative PCR) in response to SLICE exposure but the BC lice at high SLICE dose caused down regulation of two candidate genes. One of these is “degradation enzyme” and in resistant lice this enzyme has the highest overexpression, and although its role is not wholly understood, and is thought to have a role in mucus/skin digestion, the lice with the highest EC50 in bioassays also have this as their highest overexpression, suggesting a role in resistance.

In this study they crossed resistant lice with sensitive lice which reduced the EC50; they interpret reduction of EC50 (by crossing with sensitive lice) as evidence of polygenic resistance i.e. more than one gene/mechanism involved in resistance. The populations with resistance under study were assessed as

stable i.e. they bred through 4 generations in absence of SLICE and found the EC50 to persist. (Genes for resistance can be lost if there is costs associated with keeping these genes in the genome.)

Together, Sutherland et al. (2015) indicate that the resistance in New Brunswick involve many mechanisms and are likely to be incremental from sublethal dose exposure (fFresh-Constant et al., 2004). Different feeding methods resulting in differential ingestion of the drug and exposure to the lice is identified as the probable reason in New Brunswick (Igboeli et al., 2014). The levels of SLICE in tissues from Steamer and Esperanza demonstrate that there is underdosing in a subset of the population, and if this was a random sample, then the frequency of underdosing at Steamer is high. In Nootka and Esperanza Inlets, algal blooms are frequent and long lasting, resulting in a portion of the population failing to return to feeding after a period of starvation. These fish had been starved for much of August and there are likely two contributions to the underdosing: 1) the fish said to not return to feeding are actually not returning to full feeding; 2) the high size variation seen within pens at Grieg farms does not allow therapeutic levels to be delivered across the population sizes, with hierarchy determining that larger fish outcompete and the smaller fish for food.

A molecular epidemiology study of SLICE resistance in BC was presented as a poster at Aquaculture Association of Canada (Messner et al., 2015); they found two genetic signatures (SNPs i.e. single nucleotide polymorphism) clustering in Klemtu and Quatsino, areas with SLICE resistance. Sutherland et al. (2015) identified that this sort of study was appropriate follow up to their study, but there is insufficient data for interpretation at this point and the work hasn't entered the peer-reviewed literature. The work is following work from Europe, where molecular epidemiology used a SNP on the same chromosome that was accepted as strongly suggestive of spread of SLICE resistance from a single source in 1999 when the chemical was first introduced to spread across the North Atlantic by 2010 (Besnier et al., 2014). This work from Europe was supported by gene identification, which is missing from the presentation by Messner et al. (2015).

The work by Besnier et al. (2014) in Europe demonstrates how the migratory behaviour of the parasite host can spread the parasite genes across vast ranges, in a short time.

Steamer and Esperanza situation:

Sutherland et al. (2015) argue convincingly of incremental changes and resulting polygenic resistance in New Brunswick lice. However, there was dramatic change in resistance in Esperanza Inlet that could be the result of monogenic change; bioassay found, for adult females, [REDACTED] with tolerance range [REDACTED] in 2014, and [REDACTED] with range [REDACTED] in 2016. When tolerance ranges don't overlap, monogenic rather than polygenic mutation is suspected (fFrench-Contact et al., 2004). Although the first bioassay was conducted in August 2014 and the most recent in November 2016, there were only 3 treatments at Steamer Point over those 27 months. (It is true that there would have been lice recruitment by 23 November 2016, but adults and adults are collected, and these aren't likely to have been of the generation affected by the new genetics.)

Interpretation of the resistance in Esperanza Inlet appears to be sudden and substantial resistance and more likely monogenic resistance, unlike the slowly developing multiple gene resistance described by

Sutherland et al. (2015). It is possible and likely that this is the same resistance as developed in Klemtu and resolved by one year of hydrogen peroxide and no SLICE selection pressure; it would be appropriate to test the SNP used by Messner et al. (2015) to see if the hyper variable region found in Klemtu and Quatsino as support prediction of a resolution using hydrogen peroxide.

The ideal means of removing the lice is by treating with peroxide repeatedly and harvesting the fish with mobile lice removed by the peroxide, and capturing the detached lice as is occurring at Sheep Passage at this time. However, with tarping Marine Harvest was able to recover only 5% of the peroxide removed lice. [REDACTED] is right that harvesting is likely to knock off a lot of lice too through crowding, but this is better with capturing of the lice from dewatering.

Differences between the Pacific form of *L. salmonis* and the Atlantic form and pathology seen

Ian Keith, Jan 2017

There are 5 important bullets at the end of this document. The background for each is described at some length in the text that precedes them. I have begun the document with a pre-amble.

This is intended to present essential differences between the Pacific form of *Lepeophtheirus salmonis* compared with that in the North Atlantic and the factors concerning lice management here compared with those seen in the North Atlantic countries.

This has 5 parts that speak to the differences in BC compared with other regions of the world.

1. The scale of spillover in BC and its influence on lice management
2. The freshwater effects
3. Management consequences of 1&2 and the requirement of management of parasites if farming.
4. The regulatory threshold and comparison with Norway
5. The Pacific form of *Lepeophtheirus salmonis* and difference from the Atlantic form

One: The first is the very important 2005 ACRDP, ***Incorporating the natural cycles of sea lice (*L. salmonis*) production into a management strategy for sustainable aquaculture***. The title points out one of the big difference between salmon farming in BC and the rest of world: the returning fish spillover is the major source of lice on farmed fish, which Simon Jones says is why our sea lice management should be easier than in any other place in the world – any farm-induced effect on the lice population should be overcome by the new genetic recruitment each fall. (I haven't seen the data, but Sonja says that in one year of using hydrogen peroxide instead of SLICE Marine Harvest has been able to change Klemtu lice populations EC50 levels dramatically i.e. from a mean where there wasn't efficacy to a mean where they predict efficacy.)

Two: The other feature of our situation that is different from Eastern Canada, if not the rest of the salmon growing areas of the world, is that the seasonal freshwater effect naturally breaks patent infections i.e. the hatch of lice eggs does not result in the salmon host supporting development of a new generation of lice producing eggs to continue the cycle. This is not true for full salinity sites like Marsh Bay in the Port Hardy area, but it is true for most of the Broughton, Clayoquot and Sechelt sites. This is why there are farms that can be below threshold during outmigration without treatment, and why one SLICE treatment was all that was required to be near zero over the outmigration period (for the farms in Clayoquot and Broughton). There are studies demonstrating effect of low salinity on settlement of the copepodid stage i.e. the free swimming to the attached stage, and a recent study (Arriagada et al., 2016) showing effects on mobile stages.

Three: Management consequences: These are factors that influence farm management of the parasite, and management of the parasite is necessary because no matter what type of farming one is engaged

in, the native parasites have to be managed (because of the amplification of the parasite under the unnatural conditions of confinement and density). The mandate of DFO for proper control and management of the fishery, requires that the effect of spillback be known irrespective of the farmer's need to control lice burden for production reasons. Jones et al. (2007) found exposed chum to have less weight gain compared with unexposed although he couldn't kill by experimental exposure. However, Jones et al. (2008) found in challenge studies that pink salmon had a susceptibility threshold and in the lab he could kill pink salmon smolts of ≤ 0.7 g with 7.5 lice/gram. At a population level, Jones and Hargreaves (2009) estimated that in 2005 4.5% of the pink smolts were of susceptible size, with or above the threshold burden. In subsequent years the burden dropped to zero in 2008 and Marty et al. (2010) could not find farm lice abundance to influence pink salmon productivity (Broughton study).

Four: The regulatory threshold of 0.1 adult female louse during critical periods as used in Norway reflects their reality and difference in virulence of the Atlantic form of the *L. salmonis*. There are dams on Norway's major rivers which challenge the preservation of native sea trout and Atlantic salmon stocks in a similar way that dams on the Columbia River system challenge the preservation of native Chinook stocks. Any pathology and stress associated with infestation of their form of *L. salmonis* are exacerbated with the transport to above the dams. And like the chinook stocks of the Columbia system, the smolts will have stress and damage associated with the spillways and turbines so the regulator acts where it can act, at the farm to influence exposure to lice during outmigration. Whereas the ratio of wild (adult) to farmed salmon in BC has been suggested to be 1000:1, in Norway the ratio is reversed at 1:1000, so ecologically the situation is not comparable and there has been cryopreservation of sperm for a decade to deal with the declining gene pool, and more recently, embryos. We don't have these challenges and our management thresholds reflect the differences in the form of *L. salmonis* and the ecology and to keep levels as low as required in Norway is to elevate risk of SLICE resistance.

Five: Irrespective of need to manage parasites in farming, there is a genetic difference of the *Lepeophtheirus salmonis* found in the North Pacific: Yazawa R, et al. (2008) EST and mitochondrial DNA sequences support a distinct Pacific form of salmon louse, *Lepeophtheirus salmonis*. (They proposed that lesser genetic diversity was consistent with introduction of the species from North Atlantic to the Pacific. The level of divergence is consistent with the hypothesis that the Pacific form of *L. salmonis* coevolved with Pacific salmon and the Atlantic form coevolved with the Atlantic salmon independently. Phylogenetic distance of the forms coincides with the opening of the Bering Strait.) Fast et al. (2003) demonstrated phenotypic differences between *L. salmonis* from Atlantic salmon from the North Atlantic (New Brunswick, NB) and *L. salmonis* from Atlantic salmon from the Pacific (BC), showing difference in salmon mucus preferences, expressed as differences in secreted enzyme profiles. The BC louse had different and stronger response to coho salmon mucus and the NB louse had the same but stronger specific enzyme response to Atlantic salmon mucus. Some authors argue that there are sufficient differences between the Pacific form and the Atlantic form of *L. salmonis* to treat them as separate species, and this is helpful to explain what is observed on farms and wild fish, that farmed salmon in BC do not exhibit the severe pathology seen in Atlantic salmon farmed in the North Atlantic. The exception documented in the wild (Johnson et al., 1996) occurred in 1990 in the Alberni Inlet when lice-induced pathology and mortality occurred in sockeye salmon. These fish held at the head of the

Inlet for an extended period (until September) at which time there was a high intensity of *L. salmonis* infestation under conditions crowding, low dissolved oxygen and elevated temperatures. Skin erosion and mortality was similar to what was reported for untreated farmed Atlantic salmon in Europe.

Bullets which are the first principles referred to above:

1. Wild mobile lice on returning wild fish, especially the highly motile males, will move likely by pheromone attraction to breed 2nd stage preadult female lice that will result in eggs with reduced tolerance to SLICE or other farm-induced effect. (The reduction of tolerance is based on Norwegian data and supports a polygenic rather than single gene resistance mechanism.) Mobile female lice are less apt to move but can and this wild lice recruitment would be bringing new genes to the farm population. Eggs deposited from gravid females on the wild fish will hatch, introducing new genetic material to the population in and around the farm.
2. The free-swimming nauplius that hatches from a louse embryo has several moults before metamorphizing into the copepodid that is the infective stage of the louse. Successful settlement of the copepodid and attachment to a host, either salmon or stickleback, requires sufficiently high salinity. Sutherland et al. (2012) found higher stress gene expression at 27 parts per thousand compared with 30ppt. All settlement studies have been performed on the North Atlantic form of *L. salmonis*, but given that stress is expressed at 27ppt in the Pacific form, the findings that survival of the copepodid stage is severely affected by short term salinities below 29 parts per thousand in the Atlantic form (Bricknell et al., 2006) to be conservative it should be said that settlement requires higher salinity i.e. 27ppt=<. In addition, Arriagada et al. (2016) found that salinity had an effect on mobile stages of sea lice population dynamics in BC, which would be in addition to the predicted effects on settlement. These detrimental effects were found in the pre-adult stages of the louse, and potentially, on fecundity.
3. Since salmon are non-sympatric i.e. the adults are gone before the young emerge, spillback of lice from the farmed fish is recognised as a risk that has to be understood and managed. With the different species returning to river systems at different times, the same and different species of smolts outmigration at different times, the extent of lice egg hatch times from the returning salmon, and resident yearling coho and Chinook and stickleback that can be host to the lice between the adults spawning and smolts entering the sea, non-sympatric Pacific salmon does not mean that there aren't means of carrying pests from one generation to the next, that the natural life cycle of sea lice includes passage of infestation. Based on the performance to date it would suggest that the lice management for the decade after 2004 (the data in these reviews) has been successful.
4. The degree of spillback from farmed fish as defined by policy, minimized abundance during outmigration and the regulatory threshold of 3 motile *L. salmonis*, has been attainable excepting the anomalous years 2004 and 2015. Smolts have species- specific susceptible sizes, and to date pink salmon have been the only species that can be killed in experimental challenge when in the susceptible size window. In the Broughton, the year to year variation in prevalence of lice in pink

salmon smolts can be explained by the abundance of female lice on farmed fish; however, the abundance of female lice on farmed fish are predicted by the size of the pink salmon run in the previous fall (Marty et al., 2010) and the productivity of the pink fishery isn't negatively associated with the abundance of lice on the farms.

5. The Pacific form of *Lepeophtheirus salmonis* does not cause the pathology in Atlantic salmon seen with the Atlantic form at the same abundance, and genetic and phenotypic differences between the Pacific form and the Atlantic form contribute to the reasons for the differences seen.

Paylor, Adrienne

From: Paylor, Adrienne
Sent: February-09-17 5:23 PM
To: Calla, Karen
Subject: Fw: follow up on SL docs
Attachments: SLICE tolerance issue.doc; The differences in the BC form of L salmonis and differences in pathology seen.doc

In case you haven't had a chance to read these yet apparently Ian has updated them already. A

Sent from my BlackBerry 10 smartphone on the Rogers network.

From: Keith, Ian <Ian.Keith@dfo-mpo.gc.ca>
Sent: Thursday, February 9, 2017 5:11 PM
To: Paylor, Adrienne
Subject: follow up on SL docs

Hi Adrienne,
Here are the links, and should there not be linkage access for Karen I have attached the files too.
BC is unique for lice management and SLICE effectiveness is sustainable here with the support of you and Karen.

[X:\AEO\Courtenay\FH\Sea lice files\forKaren2017\The differences in the BC form of L salmonis and differences in pathology seen.doc](#)
[X:\AEO\Courtenay\FH\Sea lice files\forKaren2017\SLICE tolerance issue.doc](#)

Dr. Ian Keith DVM
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Feb 2017

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s.20(1)(b)

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The ideal means of removing the lice is by treating with peroxide repeatedly while harvesting the fish, with capturing the detached lice as is occurring at Sheep Passage at this time. However, Marine Harvest is able to retain sea lice with some success because they are using well boat treatment; with tarping Marine Harvest was able to recover only 5% of the peroxide-removed lice. [REDACTED] is right that harvesting is likely to knock off a lot of lice through crowding, and hence his argument for peroxide treatment followed by harvesting as soon after as possible is defensible. This must occur as soon as possible because peroxide-removed lice can re-attach so the treatment should occur prior to outmigration.

References:

Besnier, F., Kent, M., Skern-Mauritzen, R., Lien, S., Malde, K., Edvardsen, R., Taylor, S., Ljungfeldt, L., Nilsen, F., Glover, K., 2014. Human-induced evolution caught in action: SNP-array reveals rapid amphiatlantic spread of pesticide resistance in the salmon ectoparasite *Lepeophtheirus salmonis*. *BMC Genomics* 15:937

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Igboeli O., Burka JF, Fast MD, 2014. *Lepeophtheirus salmonis*: a persisting challenge for salmon aquaculture. *Anim Front* 4:22–32.

Messmer, A.M., Leong, J.S., Boyce, B., Morrison, D., Fast, M.D., Koop, B.F., 2015. A novel Pacific sea louse genotype associated with differential EMB efficacy. *Aquaculture Association of Canada*, Nanaimo, B.C.

Sutherland, B., Poley, J., Igboeli, O., Jantzen, J., Fast, M., Koop, B., Jones, S., 2015. Transcriptomic responses to emamectin benzoate in Pacific and Atlantic Canada salmon lice *Lepeophtheirus salmonis* with differing levels of drug resistance. *Evolutionary Applications*

Differences between the Pacific form of *L. salmonis* and the Atlantic form and pathology seen

Jan 2017

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Two: The other feature of our situation that is different from Eastern Canada and much of the salmon growing areas of the world, is that the seasonal freshwater effect naturally breaks patent infections i.e. the hatch of lice eggs does not result in the salmon host supporting development of a new generation of lice producing eggs to continue the cycle. This is predicted from lab studies but demonstrating salinity effects on abundance in the field has not been successful; however Jones et al. (2006) demonstrated a salinity effect with *Caligus clemensi* on Three-spine stickleback. This therefore is a working hypothesis and so the regulator does not prescribe how abundance is to be minimized during outmigration. There are studies demonstrating effect of low salinity on settlement of the copepodid stage i.e. the free swimming to the attached stage, and a recent study (Arriagada et al., 2016) showing effects on mobile stages, that is detrimental effects of salinity in the pre-adult stages of the louse, and potentially, on fecundity. Rainfall and ice cap melt therefore can influence infestation, both on farmed farm and outmigrating smolts. This working hypothesis is the explanation why low salinity allows farms to be

below threshold during outmigration without treatment in some areas (Sechelt), and why one SLICE treatment is all that is required to have abundance near zero over the outmigration period in other areas (Clayoquot and areas of the Broughton).

Three: Management consequences: These are factors that influence farm management of the parasite, and management of the parasite is necessary because no matter what type of farming one is engaged in, the native parasites have to be managed (because of the amplification of the parasite under the unnatural conditions of confinement and density), with the exception of one year old coho farming in Japan, where the resistance of coho to *L. salmonis* and the short (one year) production cycle preclude the need for treatment (Ho and Nagasawa, 2001). The mandate of DFO for proper control and management of the fishery, requires that the effect of spillback be known. Jones et al. (2007) found exposed chum to have less weight gain compared with unexposed although he couldn't kill by experimental exposure. However, Jones and Hargreaves (2009) found in challenge studies that pink salmon had a susceptibility threshold and in the lab he could kill pink salmon smolts of $\leq 0.7g$ with 7.5 lice/gram. At a population level, Jones and Hargreaves (2009) estimated that in 2005 4.5% of the pink smolts were of susceptible size, with or above the threshold infection intensity (burden). In subsequent years the burden dropped to zero in 2008 and Marty et al. (2010) could not find farm lice abundance to influence pink salmon productivity (Broughton study).

Four: The regulatory threshold of 0.1 adult female louse during critical periods as used in Norway reflects their reality and difference in virulence of the Atlantic form of the *L. salmonis*. There are dams on Norway's major rivers which challenge the preservation of native sea trout and Atlantic salmon stocks in a similar way that dams on the Columbia River system challenge the preservation of native Chinook stocks. Any pathology and stress associated with infestation of their form of *L. salmonis* are exacerbated with the transport to above the dams. And like the chinook stocks of the Columbia system, the smolts will have stress and damage associated with the spillways and turbines so the regulator acts where it can act, at the farm to influence exposure to lice during outmigration. Whereas the ratio of wild (adult) to farmed salmon in BC has been suggested to be 1000:1, in Norway the ratio is reversed at 1:1000, so ecologically the situation is not comparable and there has been cryopreservation of sperm for a decade to deal with the declining gene pool, and more recently, embryos. We don't have these challenges and our management thresholds reflect the differences in the form of *L. salmonis* and the ecology and to keep levels as low as required in Norway is to elevate risk of SLICE resistance.

Five: There is a genetic difference of the *Lepeophtheirus salmonis* found in the North Pacific: Yazawa R, et al. (2008) EST and mitochondrial DNA sequences support a distinct Pacific form of salmon louse, *Lepeophtheirus salmonis*. (They proposed that lesser genetic diversity was consistent with introduction of the species from North Atlantic to the Pacific. The level of divergence is consistent with the hypothesis that the Pacific form of *L. salmonis* coevolved with Pacific salmon and the Atlantic form coevolved with the Atlantic salmon independently. Phylogenetic distance of the forms coincides with the opening of the Bering Strait.) Fast et al. (2003) demonstrated phenotypic differences between *L. salmonis* from Atlantic salmon from the North Atlantic (New Brunswick, NB) and *L. salmonis* from Atlantic salmon from the Pacific (BC), showing difference in salmon mucus preferences, expressed as differences in secreted enzyme profiles. The BC louse had different and stronger response to coho

salmon mucus and the NB louse had the same but stronger specific enzyme response to Atlantic salmon mucus. Some authors argue that there are sufficient differences between the Pacific form and the Atlantic form of *L. salmonis* to treat them as separate species, and this is helpful to explain what is observed on farms and wild fish, that farmed salmon in BC do not exhibit the severe pathology seen in Atlantic salmon farmed in the North Atlantic. The exception documented in the wild (Johnson et al., 1996) occurred in 1990 in the Alberni Inlet when lice-induced pathology and mortality occurred in sockeye salmon. These fish held at the head of the Inlet for an extended period (until September) at which time there was a high intensity of *L. salmonis* infestation under conditions crowding, low dissolved oxygen and elevated temperatures. Skin erosion and mortality was similar to what was reported for untreated farmed Atlantic salmon in Europe.

Bullets which are the first principles referred to above:

1. Wild mobile lice on returning wild fish, especially the highly motile males, will move likely by pheromone attraction to breed 2nd stage preadult female lice that will result in eggs with reduced tolerance to SLICE or other farm-induced effect. (The reduction of tolerance is based on Norwegian data and supports a polygenic rather than single gene resistance mechanism.) Mobile female lice are less apt to move but can and this wild lice recruitment would be bringing new genes to the farm population. Eggs deposited from gravid females on the wild fish will hatch, introducing new genetic material to the population, in and around the farm.
2. The free-swimming nauplius that hatches from a louse embryo has two moults before metamorphosing into the copepodid that is the infective stage of the louse. Successful settlement of the copepodid and attachment to a host, either salmon or stickleback, requires sufficiently high salinity. Sutherland et al. (2012) found higher stress gene expression at 27 parts per thousand compared with 30ppt in the Atlantic form of *L. salmonis*. All settlement studies have been performed on the North Atlantic form of *L. salmonis*, but given the findings that survival of the copepodid stage is severely affected by short term salinities below 29 parts per thousand in the Atlantic form (Bricknell et al., 2006), to be conservative it should be said that settlement requires higher salinity i.e. 27ppt=<. These lab studies would predict lower abundance and fewer treatment requirements in areas with conditions of lowest salinity and areas where salinity is sufficiently reduced during key times.
3. Since salmon are non-sympatric i.e. the adults are gone before the young emerge, spillback of lice from the farmed fish is recognised as a risk that has to be understood and managed. With the different species returning to river systems at different times, the same and different species of smolts outmigration at different times, the extent of lice egg hatch times from the returning salmon, and resident yearling coho and Chinook and stickleback that can be host to the lice between the adults spawning and smolts entering the sea, non-sympatric Pacific salmon does not mean that there aren't means of carrying pests from one generation to the next, that the natural life cycle of sea lice includes passage of infestation. Based on the performance to date it would suggest that the lice management for the decade after 2004 (the data in these reviews) has been successful.

4. The degree of spillback from farmed fish as defined by policy, minimized abundance during outmigration and the regulatory threshold of 3 motile *L. salmonis*, has been attainable excepting the anomalous years 2004 and 2015. Smolts have species- specific susceptible sizes, and to date pink salmon have been the only species that can be killed in experimental challenge when in the susceptible size window. In the Broughton, the year to year variation in prevalence of lice in pink salmon smolts can be explained by the abundance of female lice on farmed fish; however, the abundance of female lice on farmed fish are predicted by the size of the pink salmon run in the previous fall (Marty et al., 2010) and the productivity of the pink fishery isn't negatively associated with the abundance of lice on the farms.
5. The Pacific form of *Lepeophtheirus salmonis* does not cause the pathology in Atlantic salmon seen with the Atlantic form at the same abundance, and genetic and phenotypic differences between the Pacific form and the Atlantic form contribute to the reasons for the differences seen.

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Paylor, Adrienne

From: Paylor, Adrienne
Sent: February-15-17 8:43 AM
To: Saksida, Sonja
Subject: FW: IPM
Attachments: IPM v15.docx

fyi

From: Lavigne, Lauren
Sent: Tuesday, February 14, 2017 4:26 PM
To: Calla, Karen; Paylor, Adrienne; Klaver, March
Cc: Chamberlain, Jon
Subject: Fw: IPM

Hi Everyone,

The attached Integrated Pest Management document was discussed at the Strategic Working Group meeting on Friday. Industry members of the SWG indicated they were very pleased with the document and were going to do one final review for minor edits, etc.

I was also hoping the Management team could review - as we are planning on tabling this document at FAIAP in April.

Jon has done a great job in moving this document forward and in having some frank conversations to make sure the tone is right. [REDACTED] Thank you for your efforts.

Everyone might not have a chance to review for the managers call tomorrow, maybe we can discuss next week?

Thanks!

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Report of the DFO-Industry Marine Finfish
Strategic Working Group (SWG) to the
Finfish Aquaculture Industry Advisory Panel
(FAIAP) on:

Integrated Pest Management Approach to
Sea Lice Management for BC Atlantic
Salmon Aquaculture Facilities

February 2017

FINAL DRAFT FOR REVIEW

Overview

Sea lice are naturally occurring pests that infect farmed salmon and a variety of wild fish including Pacific salmon. In British Columbia, the Department of Fisheries and Oceans (DFO) regulates sea lice levels on farmed salmon through the conditions of license for each aquaculture site. Regulatory oversight includes monitoring, reporting, and setting thresholds for management action. Industry veterinarians and fish health staff are responsible for sea lice management programs. DFO and the BC salmon aquaculture industry see the successful management of sea lice at salmon farms as a critical element of the long-term sustainability of the sector.

The management of pests on farmed animals in general has evolved into comprehensive Integrated Pest Management (IPM) programs that minimize the effects of the pest through a combination of preventative and curative strategies. Core elements of IPM include: prevention, monitoring, thresholds for action, and control through a suite of management tools (physical, biological and chemical). IPM is founded on a commitment to continual improvement through the development/adoption of new technology (tools), management processes and treatments as they become available.

Table 1 Sea lice IPM Objectives

- 1** - Strategic sea lice management that promotes farmed salmon health and minimizes the effects of sea lice on both farmed salmon and wild fish.
- 2** – Optimizing sea lice treatments to achieve maximum efficacy while minimizing environmental residues and potential effects on non-target organisms.
- 3** – Reducing the potential resistance development to management tools.
- 4** – Ongoing investigation, research and investment into new management tools.

DFO and the BC salmon aquaculture industry recognize the importance of a comprehensive sea lice management approach and support the implementation of an IPM approach with the above objectives. To enable the development of an IPM approach to move forward, a number of foundational elements have been identified (Table 2). Together, these elements will support the establishment of an effective IPM at aquaculture facilities in BC.

Table 2 Requirements to Implement IPM Objectives

- 1** – Additional treatments and methods made available for the salmon farming industry in BC including tools used in other parts of the world.
- 2** – Federal, provincial and industry-supported research programs that target innovative approaches to sea lice management.
- 3** – Financial and regulatory support to enable the testing and implementation of innovative tools.
- 4** – Financial and regulatory support for commercialization of new tools.

The purpose of this document is to describe the current state of knowledge regarding sea lice IPM approaches, establish a baseline of IPM elements, and identify opportunities to advance IPM strategy for sea lice management in British Columbia. The core information is in following sections and details on Sea Lice Management in BC, Sea lice Biology and Elements of IPM can be found in the appendices.

Integrated Pest Management Approach to Sea Lice Management for BC Atlantic Salmon Aquaculture Facilities

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This document is the result of a collaborative effort between the marine finfish aquaculture industry representatives and DFO Aquaculture Management under the guidance of the DFO-Industry Marine Finfish Strategic Working Group. The context is not regulatory or scientific in nature. It reflects the opinions and expertise of a range of subject matter experts (SMEs) to set out a State of Knowledge of best practice around the Integrated Pest Management Approaches for Marine Finfish Aquaculture.

Sea Lice in British Columbia

Two main species of sea lice are the focus of the IPM for aquaculture in BC - *Lepeophtheirus salmonis* (the 'salmon louse') and to a lesser extent *Caligus clemensi* (the 'herring louse'). Both species are naturally occurring parasites that attach to skin, fins and gills of fish and feed on the mucus and skin. Their distribution varies seasonally, annually and regionally on both farmed and wild salmon. The intensity of infections also varies by species, location and years. Water temperature, salinity and water movement are the major factors influencing sea lice life cycle as is the number of returning wild fish in the area. Other species of marine fish (herring, stickleback, rockfish, greenling, ratfish and Pollock) are also known to host sea lice and may serve as reservoirs for infestation on salmonids.

The number of sea lice on farmed Atlantic salmon is influenced by many factors including the age of the salmon or time in seawater; location and season; salinity and numerous other environmental factors affecting both the sea lice and the host; proximity to sources of sea lice; and application of sea lice treatments.

In addition to these factors, there is a wide range of infestation among the different species of Pacific salmon that also varies with size of the fish. Atlantic salmon have greater susceptibility and are less likely to shed sea lice compared to Pacific salmon. See Appendix A for more information on sea lice management in BC and Appendix B for information on sea lice life history, abundance and distribution, and host susceptibility.

Sea Lice and Aquaculture

BC farmed salmon begin their lives in freshwater hatcheries and are transferred to ocean net pens lice free. Once in the ocean, farmed salmon are exposed to sea lice from a variety of sources, particularly in the fall as adult wild salmon carrying sea lice return to the coast from the open ocean.

To date, the impact of sea lice on cultured Atlantic salmon in BC appears to be less than in other jurisdictions. Farmed Pacific salmon are also susceptible to sea lice but generally at lower levels. Concerns regarding the potential for sea lice from aquaculture facilities to impact the health of wild migratory salmon stocks led to the establishment of precautionary management thresholds. For Atlantic salmon farms, licence holders must take action to reduce the absolute lice inventory at a farm if the sea lice abundance exceeds the threshold during the wild salmon out migration period (March 1-June 30). During the rest of the year, licence holders must provide DFO with a plan that describes how a reported threshold exceedance will be addressed. For Pacific salmon farms, licence holders must notify DFO if thresholds are exceeded during the wild salmon out migration period.

Core Elements of an IPM for Aquaculture

A key component of an IPM strategy is reducing the potential for sea lice resistant to management tools which would reduce the effectiveness of the tool. As such, IPM requires a commitment to continual improvement through the development/adoption of new technology, management processes and treatments as they become available. The four core elements of IPM include prevention, monitoring, thresholds for action, and a suite of management tools. For a more detailed description of the core elements, see Appendix C.

Integrated Pest Management Approach to Sea Lice Management for BC Atlantic Salmon Aquaculture Facilities

Prevention

Sea lice are naturally occurring and are present in the farming areas and on the wild fish in the areas. Prevention measures undertaken to manage the numbers of sea lice on farmed salmon include:

- Appropriate siting of aquaculture facilities to manage sources and transmission of sea lice to farmed fish, to maintain water quality for stock husbandry, and to operate the site efficiently.
- Good husbandry practices to maintain the health of farmed fish include management activities; such as year class separation, fallowing, biofouling (organisms and shellfish attaching to infrastructure) removal, plankton bloom mitigation, nutrition management, predator control, and hygiene protocols.
- Strategic use of tools such as site fallowing, area based management, and harvesting.
- Outside of BC, the use of sea lice resistant fish stocks produced through selective breeding programs.

Monitoring

- Routine monitoring of sea lice numbers by fish health professionals provide a site-specific picture of sea lice population dynamics which enables proactive/optimal use of all management tools throughout the production cycle.

Thresholds for Action

- Thresholds, established by DFO, identify when management actions are to be initiated.
- Thresholds must take into consideration environmental risks, potential for development of resistance with chemotherapeutants, and the potential success of reducing the number of sea lice.

Suite of Management Tools

- Once a threshold has been met sea lice management is initiated.
- Each response is unique and depending on the situation may include more than one management tool.
- A clear decision framework ensures the appropriate tools are being used, taking into consideration environmental effects, efficacy of the tool, and regulations on the use of each tool.

Chemical Controls - Therapeutants include a variety of compounds used to treat sea lice on farmed salmon – topically and internally. See Table 3 for a list of therapeutants available globally and those in use in BC. These chemicals have generally been adapted from drugs or pesticides used in terrestrial agricultural operations. Veterinary drugs and pest control products are regulated in Canada by Health Canada's Veterinary Drugs Directorate and Pest Management Regulatory agency respectively. In British Columbia, the use of pest control products also requires authorization from the provincial Ministry of Environment (generally a Pesticide Use Permit).

Integrated Pest Management Approach to Sea Lice Management for BC Atlantic Salmon Aquaculture Facilities

Also included in this group are vaccines and immunostimulants which are currently under research and development processes. Vaccines may be developed that provide immunity to sea lice infections while immunostimulants may activate the immune system of fish to reduce infection rates. In Canada, vaccines for animals are regulated by the Canadian Food Inspection Agency.

Physical Controls - Physical controls, such as structural barricades and/or physical mechanisms to block or remove sea lice from fish, are a key element of an IPM strategy. Control measures include lice skirts/filter tarps and mechanical removal. Other approaches are being developed and may be commercially available in the next five years. See Table 4 for a list of alternative approaches and strategies available in use globally and in BC.

Biological Controls - Biological controls include the use of other fish species that consume or clean sea lice from farmed salmon. In Europe, cleaner fish have been proven effective in removing sea lice. The BC salmon farming industry is supporting research under the Marine Environmental Research Program to identify suitable local cleaner fish species.

Moving an IPM Approach Forward

DFO and the BC salmon aquaculture industry recognize the importance of a comprehensive sea lice management approach and support the implementation of an IPM approach. Several future activities are required to implement this approach fully. See Appendix C for the details of IPM core elements.

1: Expansion of Commercially Available Therapeutant Measures

The table below lists options available globally for sea lice management. Veterinary drugs and pest control products are regulated for sale in Canada by Health Canada's Veterinary Drugs Directorate and Pest Management Regulatory agency respectively. In BC, two federally registered therapeutants are available; emamectin benzoate (SLICE®) which is available for use, and the topical product hydrogen peroxide (Interlox Paramove 50®) which requires an additional BC Ministry of Environment Pesticide Use Permit.

Table 3 Sea lice Treatments Used Globally and Treatments Currently Used in BC			
Product	Application Method	Status of Treatments: R&D or In Use	
		British Columbia	Other Countries
Aqui-S (active ingredient eugenol)	Bath	NOT CURRENTLY AVAILABLE	In Use: New Zealand, Australia, USA, Chile, Norway
Ektobann/Calicide (active ingredient teflubenzuron)	In-feed	NO LONGER AVAILABLE	In Use: Ireland (partial), Scotland, Norway, Canada, Faroe Islands

Integrated Pest Management Approach to Sea Lice Management for BC Atlantic Salmon Aquaculture Facilities

Table 3 Sea lice Treatments Used Globally and Treatments Currently Used in BC

Excis/Betamax (active ingredient cypermethrin)	Bath	NOT CURRENTLY AVAILABLE	In Use: Chile, Ireland (partial), Scotland, Norway, Tasmania, USA, Tasmania, Eastern Canada, Faroe Islands
Alphamax (active ingredient deltamethrin)	Bath	NOT CURRENTLY AVAILABLE	In Use: Eastern Canada, Chile, Ireland (partial), Scotland, Norway, Tasmania, USA, Eastern Canada, Faroe Islands
Releeze (active ingredient diflubenzuron)	In feed	NOT CURRENTLY AVAILABLE	In Use: Chile, Norway, Tasmania, Faroe Islands
IMVIXA (lufenuron)	In feed for freshwater	NOT CURRENTLY AVAILABLE	In Use: Chile
Salmonsan (active ingredient azamethiphos)	Bath	NOT CURRENTLY AVAILABLE	In Use: Eastern Canada, Chile, Ireland (partial), Scotland, Norway, Tasmania, Faroe Islands
Slice (active ingredient emamectin benzoate)	In feed	IN USE	In Use: Canada, Chile, Ireland, Scotland, Norway, Tasmania, USA, Faroe Islands
Interlox Paramove 50 (active ingredient hydrogen peroxide)	Bath	IN USE AT PERMITTED SITES	In Use: Canada, Chile (partial), Ireland, Scotland, Norway, Tasmania, USA, Faroe Islands

2: Research and Development of IPM Alternative Approaches and Strategies

Research conducted in other areas has supported development of innovative methods to manage sea lice. Table 4 shows the variety of tools now available globally and the status of these tools in BC.

Integrated Pest Management Approach to Sea Lice Management for BC Atlantic Salmon Aquaculture Facilities

Table 4 IPM Alternative Approaches and Strategies Under Development Globally and Status in BC

Tool	Application Method	Status of Tools: Requires R&D or In Use	
		British Columbia	Other Countries
Lice skirts	On site	R&D	In Use: Ireland, Scotland, Norway, Faroe Islands, Chile
Hydrolicer	Barge	R&D	In Use: Ireland, Scotland, Norway, Faroe Islands
Deep lights/deep feeding	On site	R&D	In Use: Scotland, Norway
Thermolicer	Barge/Boat	R&D	In Use: Scotland, Norway, Chile
Laser	Onsite	R&D	In Use: Scotland, Norway
Snorkel sea cages	On site	R&D	R&D
Fresh water	Well boat/On site	R&D	In Use: Norway, Ireland, Scotland
Immunostimulants	In feed	R&D	In Use Ireland, Scotland, Norway, Faroe Islands, Chile
Vaccines	Injected	R&D	R&D
Cleaner Fish	Co-culture	R&D	In Use: Ireland, Scotland, Faroe Islands, Norway, east coast of Canada
Resistant broodstock selection	Genetic mapping	R&D	In Use: Norway
Facility siting	On site	In Use	In Use: All
Dispersal models	ABM	In Use for some sites	Under development in most jurisdictions

3: Pilot Testing of Innovative Measures

Solutions identified through research and development activities then need to be tested in a production setting to evaluate potential usefulness and to fine tune the technology or process to improve effectiveness. This requires government and industry support for pilot projects from both regulatory and financial perspectives. Funding programs targeting innovation and pre-commercialization pilot projects (e.g. DFO's Aquaculture Innovation and Market Access Program) have been effective in helping transform valuable R&D concepts into commercially useful solutions.

4: Commercialization of New Tools

Financial support is essential to bridge the gap between R&D innovation and the commercialization of new tools. The support could be used to reduce development barriers such as scalability and marketing. As tools become commercialized, market pull has the potential to drive further innovation in BC. It also generates a healthy business environment with increased access to capital investment. This important feedback loop would ensure that BC salmon farmers are positioned at the forefront of ongoing development to ensure a long term successful IPM.

Summary

DFO and the BC salmon aquaculture industry recognize the importance of a comprehensive sea lice management approach and support the implementation of an IPM strategy that minimizes the effects of sea lice on both farmed salmon and wild fish.

A successful IPM approach requires expansion of the currently limited suite of tools available to the BC salmon farming industry through research and development of new management tools, thereby optimizing sea lice treatments and reducing potential resistance.

Moving forward and developing a successful IPM for sea lice will require the following.

- Additional treatments and methods made available for use in BC including tools used in other parts of the world.
- Federal, provincial and industry-supported research programs that target innovative approaches to sea lice management.
- Financial and regulatory support to enable the testing and implementation of innovative tools.
- Financial and regulatory support for commercialization of new tools.

Appendix A Sea Lice Management for Atlantic Salmon Farms in BC

In British Columbia, DFO issues licenses for marine finfish aquaculture that include monitoring and intervention requirements at threshold limits for the number of sea lice on fish. For Atlantic salmon farms, licence holders must take action to reduce the absolute lice inventory at aquaculture facilities if the sea lice abundance exceeds the threshold during the wild salmon out migration period. During the rest of the year, licence holders must provide DFO with a plan that describes how a reported threshold exceedance will be addressed.

Prior to 2002, sea lice infestations at BC aquaculture facilities were not considered a significant concern. Treatments for sea lice infestations were rare and there was limited data recorded. In 2002, an unexpectedly low return of Pink salmon and growing concern about sea lice found on wild Atlantic salmon in Europe, led to reports in scientific journals and the print media suggesting that in BC sea lice from Atlantic salmon farms were negatively impacting juvenile wild Pink salmon, and in turn, affecting wild salmon returns.

In 2003, the provincial government, who was the regulator, initiated the Sea Lice Management Strategy that included sea lice monitoring systems and control measures on BC salmon farms. The strategy stipulated that during the period of juvenile Pink salmon migration out of the nearshore, from March through to the end of June, sea lice species *Lepeophtheirus salmonis* were to be maintained below three motile (i.e. having the power to move spontaneously) lice per fish. If levels exceeded this threshold during this three-month period, the fish were to be treated or harvested. Management options during the remainder of the year were at the discretion of the license holder.

The sea lice threshold was selected by government and industry as a level that would allow precautionary management while scientific data was gathered to better determine the relationship between sea lice on wild and farmed fish.

It was also acknowledged that there was a lack of serious effects of sea lice on BC farmed salmon compared to other global jurisdictions due to genetic difference in the sea lice species. Further, that the large populations of wild salmon in BC are known to carry sea lice and contribute to sea lice abundance on farmed salmon particularly during the summer and fall migration period.

In 2010, DFO assumed regulatory responsibility for aquaculture activities in British Columbia. Threshold levels, monitoring and audit programs remained similar to those used by the provincial government with the exception that licence holders were required to report sea lice levels directly to DFO.

In the 2016 BCSFA Sustainability Progress Report, the BC salmon farming industry re-iterated the commitment to sea lice management through an IPM strategy to meet the required standards of both governmental regulators and third-party certification bodies, such as the Global Aquaculture Alliance's Best Aquaculture Practises certification and Aquaculture Stewardship Council's certification.

Appendix B Sea Lice Biology

Life Cycle and Distribution

Sea lice are naturally occurring parasites that reside on the bodies of both wild and farmed fish. They attach themselves to the skin, fins, and gills of fish and feed on mucus and skin. The term “sea lice” refers to several life stages and species of parasitic copepods. For aquaculture sea lice management in British Columbia, there are two main species of interest – *Lepeophtheirus salmonis* and *Caligus clemensi*.

Sea lice life history is broadly divided into free-living and parasitic phases. The copepodid stage is the most common stage that infects salmon although some transfer of pre-adult and adult stages does occur between fish. Water temperature, salinity and water movement (from tides and currents) are the major physical and environmental factors influencing sea lice dynamics. Temperature and salinity influence sea lice development, growth, survival and reproduction rate. Currents and water column mixing processes influence the transport and dispersal of the free-living stages of sea lice (nauplius and copepodid stages).

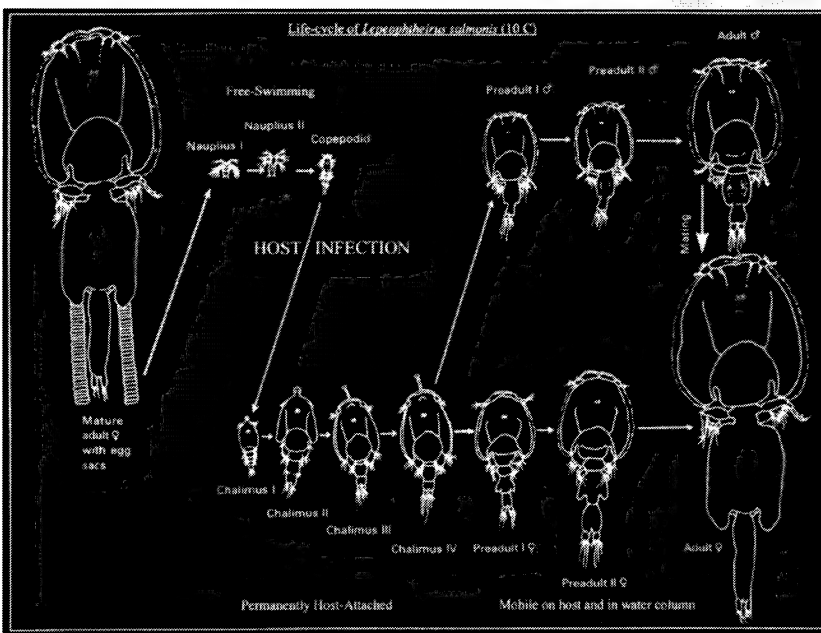


Figure 1 Life Cycle of *Lepeophtheirus salmonis* from A. Shinn and J. Bron unpublished
http://www.dfo-mpo.gc.ca/csas-sccs/publications/resdocs-docrech/2014/2014_060-eng.pdf (42/112)

Sea lice distribution and prevalence varies seasonally, annually and regionally on both farmed and wild fish. The influence of wild fish as sea lice hosts is well documented. In the Broughton Archipelago, the number of returning Pink salmon is a key factor to predict the number of sea lice on farmed salmon for the following spring.

Hosts and Host Susceptibility

Host susceptibility, the host being a wild fish or farmed fish, varies between fish species. Host response, damage to the host, and the quantity of wild hosts in the ecosystem all affect the number of sea lice on farmed salmon.

There is a wide range of susceptibilities to infestation with *L. salmonis* sea lice on Pacific salmon. The abundance of sea lice on Pacific salmon is influenced by many factors, including:

- species of salmon;
- the age of the salmon;
- its length of time in seawater;
- by sea lice location and season;
- the proximity of the host fish to sources of sea lice;
- the application of sea lice treatments on farmed fish; and
- by numerous other environmental factors affecting both the sea lice and the wild fish or farmed fish host.

Farmed Atlantic salmon are transferred from freshwater hatcheries to ocean net pens. In the ocean, farmed salmon are exposed to sea lice from a variety of sources, particularly wild salmon returning to their spawning grounds. Atlantic salmon are more susceptible to sea lice infestation than the various species of Pacific salmon. Atlantic salmon would be the most likely salmonid to have *L. salmonis* sea lice and the least likely to shed them naturally. Despite this susceptibility, no harm to Atlantic salmon stocks at farm sites has been observed in BC.

Non-salmonid species also host sea lice and are potential reservoirs for the transfer of sea lice to both wild and farmed salmon. Many species of marine fish (herring, stickleback, rockfish, greenling, ratfish, sandlance, lingcod and Pollock) are known to host *Caligus species*. Similarly, *L. salmonis* occur on Pacific sand lance, lingcod, three-spine stickleback and white sturgeon. The duration and intensity of sea lice vary by species, location and among year classes of the host fish.

Appendix C Detailed Elements of an IPM Strategy for Sea Lice

Prevention - Facility Siting

At least initially, sea lice infestations are predominantly derived from wild hosts in the area and from sea lice drifting into the area on prevailing currents. Siting farms away from locations where wild salmon are known to concentrate (e.g. salmon bearing rivers/streams and estuarine holding areas), can be useful in the prevention of infection.

Characteristics such as water depth, tidal range, currents and sea bottom types are considered by both industry and regulators in siting assessments as they influence the environmental sustainability of the farm. In particular, good water flow can prevent build-up of sea lice larvae at a site and can contribute to the dispersion of therapeutants following a treatment.

The distance between farms is a provincial and federal requirement. Spacing between farms can reduce the transmission of sea lice between farms. Facilities operating on a common or shared production cycle within a defined area can also co-ordinate treatments on an area-based level.

Prevention - Husbandry

Good husbandry practices are an important and key aspect of sea lice management and prevention. Maintaining the health of farmed fish and mitigating potential risks from interactions between farmed and wild stocks are integral components of the aquaculture operators' mandatory Health Management Program (HMP). This is achieved through a number of management activities as described below.

Year Class Separation

Year class separation is considered one of the most effective IPM-related husbandry techniques, with production sites stocked as a single year class and an all-in/all-out harvest policy. Juveniles are not introduced into facilities where older fish are already at the farm. This reduces juvenile salmon exposure to sea lice from older fish. Where year class separation is not feasible, treating salmon already on the farm will reduce lice numbers before introducing new fish.

Biofouling Removal

Routine in-situ net cleaning ensures the water flow through the site is optimized, reducing stress and improving the general health of cultured stock. Removal of net biofouling also reduces the number of sea lice eggs and larval stages.

Plankton Blooms Management

Plankton management indirectly mitigates the risks associated with sea lice by reducing stress on the salmon and improving fish health. Activities may include a HAMP (Harmful Algal Monitoring Program) and plankton mitigation measures such as deployment of bubble walls, tarpaulin skirts and aeration.

Integrated Pest Management Approach to Sea Lice Management for BC Atlantic Salmon Aquaculture Facilities

Nutrition Management

Maintaining fish health increases the efficacy of sea lice treatments and the opportunities for applying other types of sea lice management. This includes the use of high quality feed and feeding management integrated with fish health support.

Predator Control Management

Predators are stressful for farmed fish with related risks to fish health. Predator control measures (e.g. deployment of bird nets, shark guards, full predator nets) reduces the potential stress.

Hygiene Protocols

Farm operational hygiene within the operator's comprehensive Fish Health Management Plan is required for all licenced facilities. This includes daily removal of mortalities, regular cleaning of equipment, limiting visitors, and restricting extensive movements of equipment.

Prevention – Resistant Broodstock Selection

Internationally, commercial fish breeding programs are developing 'sea lice resistant' stocks. Currently, there are no commercial breeding companies working in BC. Individual farming companies do have breeding programs, but selection for sea lice resistance has not occurred.

The scale of the BC aquaculture industry has been a limitation to attracting innovation and investment. Currently there are only a few small local facilities to support sea lice challenges and genetic testing in BC. Support for larger institutes and existing facilities, such as the BC Centre for Aquatic Health Sciences, to provide these services, is key to developing the suite of tools necessary for an Integrated Pest Management system.

Monitoring and Identification

Decisions on when to conduct a sea lice treatment at a farm are based on the results from a program of routine monitoring of sea lice numbers, managed by the operator's fish health professionals. Monitoring is conducted continuously following the transfer of juveniles from hatchery through to harvest. Fish health staff evaluate sea lice populations and develop assessments and optimal management practises. IPM-linked activities include routine monitoring, training staff on sea lice identification, and reporting sea lice abundance at the facility.

Thresholds for Action

Thresholds of the number of sea lice that trigger treatment, are determined by accounting for potential risks of the sea lice becoming resistant to treatment, the operator's obligation to safeguard the farmed salmon, and ability to reduce the real or perceived risks associated with the transfer of sea lice from farmed fish to wild fish.

A threshold that is too low can lead to unnecessary treatments which can accelerate the development of sea lice resistance.

Current regulatory thresholds in BC set out in DFO's conditions of licence are as follows:

Integrated Pest Management Approach to Sea Lice Management for BC Atlantic Salmon Aquaculture Facilities

- Calendar year March 1 to June 30: if the sea lice count exceeds 3 motile lice (*Lepeophtheirus salmonis*) per fish the operator will implement a plan to reduce absolute sea lice inventory within 15 days.
- July 1 to February 28: if the sea lice count exceeds 3 motile lice (*Lepeophtheirus salmonis*) per fish then the operator will provide a plan to DFO to address this within 30 days.

Control Measures

Biological

The use of cleaner fish, such as wrasse or lumpstickers, to remove sea lice from salmon has shown promising results in Norway and Scotland. BC's salmon farming industry is currently supporting research under the Marine Environmental Research Program (MERP) to identify potential local species that may act as cleaner fish to remove sea lice from farmed salmon in BC. And industry group is also working with DFO to determine the regulations and protocols required around various options for the use of biological measures.

Therapeutants

In BC, there are two fully registered therapeutants available.

SLICE® became available for veterinarians to administer under special permit, Emergency Drug Release or EDR, obtained from Health Canada in 1999 and gained full registration approval in 2000. Until 2013, SLICE® was the only therapeutant used for sea lice in British Columbia.

BC's salmon farming industry is concerned about the inherent limitation of having only one sea lice treatment product available. This situation differs from other agricultural practices which utilize a rotation of treatments as part of an integrated pest management program to increase effectiveness and prevent or delay development of resistance to treatments.

Interlox Paramove 50® became available for use under an Emergency Use Registration label in October 2013 and received full registration in March 2015. However, applications are limited as environmental conditions can prevent the use of Paramove 50®. During plankton blooms and during certain periods, SLICE® is the sole therapeutic treatment option. BC's Ministry of Environment requires application for a Pesticide Use Permit prior permission for the use of Interlox Paramove 50® at aquaculture facilities.

Vaccines and Immunostimulants

Vaccines and immunostimulants, or functional feeds, are potential tools for sea lice control. These products are currently under development.

Others

Non-therapeutic control measures such as tarps, lice skirts, mechanical removal and freshwater bathing are being investigated by BC operators. Methodologies are still being refined as physical controls can be stressful for the farmed salmon and removal efficacy varied. Further research is required to determine how these methods will be used in BC.

Examples of new types of treatments are:

Integrated Pest Management Approach to Sea Lice Management for BC Atlantic Salmon Aquaculture Facilities

- Thermolicer, (<http://www.steinsvik.no/en/products/e/seaculture/fish-health/thermolicer/>);
- Hydrolicer (<http://www.fishfarmingexpert.com/news/hydrolicer-unveiled/>)

Freshwater treatments have also been trialed but require significant infrastructure as the treatments are seven hours in duration.

Other approaches are still under development and may be commercially available in the next five years, including the Snorkel lice barrier system and Stingray delousing.

(['Snorkel' sea lice barrier technology reduces sea lice loads on harvest-sized Atlantic salmon with minimal welfare impacts](https://www.researchgate.net/publication/294579093)), (<http://en.stingray.no/>)

Appendix D Bibliography

The following list of references and materials were used during the development of this document.

Health Canada – Integrated Pest Management of Sea Lice in Salmon Aquaculture
(<http://publications.gc.ca/collections/Collection/H114-9-2003E.pdf>)

Lepeophtheirus salmonis: a persisting challenge for salmon aquaculture (doi:10.2527/af.2014-0004)

A SUMMARY OF SEA LICE IN BC – WILD AND FARMED MONITORING AND MANAGEMENT Saksida 2015

Detection of emamectin benzoate tolerance emergence in different life stages of sea lice,
Lepeophtheirus salmonis, on farmed Atlantic salmon, *Salmo salar* L. P G Jones et al 2013 doi:10.1111/jfd.12022

Integrated Pest Management of Sea Lice in Salmon Aquaculture – Myron Roth presentation Speaking for
the Salmon - <https://www.sfu.ca/cstudies/science/resources/1273698226.pdf>

Paylor, Adrienne

From: Paylor, Adrienne
Sent: March-03-17 8:58 AM
To: Lavigne, Lauren; Calla, Karen
Subject: FW: draft BN for today
Attachments: MemoSeaLIce ssik.docx

FYI Not sure how far gone the briefing note is but Ian had forgot to attach his comments.

From: Keith, Ian
Sent: Friday, March 03, 2017 1:32 AM
To: Paylor, Adrienne
Subject: FW: draft BN for today

My apologies.

Please find it attached.

Briefly:

Said their plan was to use Marine Harvest to deliver peroxide treatment.

Their 30 day announcement in the newspaper to publicize that they want a permit for using peroxide appeared December 15; no opposition by January 15 (although I called January 22 and it certainly wasn't top of mind for Grieg).

██████████ called January 26 saying that the Marine Harvest barge is delayed and availability is April 1. Ian said: "The regulator has stepped in historically." ██████████ said: "the reason we waited was availability of the equipment from Marine Harvest." ██████████ said that they are now getting a barge of our own. Ian said: "I'll pass the news up the chain."

██████████ said: "Understood."

They scheduled their meeting with the bands in Esperanza to get their letters of support for use of peroxide February 3. They said they had sent letters earlier but had received no response, but I don't know when they had sent these letters.

██████████ others from the company (and interested Marine Harvest and Cermaq participants) received application certification training February 7 & 8.

They received their pesticide use permit on Wednesday, February 15 but required 7 days of an announcement in the newspaper to publicize that they were going to use the pesticide. They waited till the next Wednesday before posting of the announcement so that they could legally use the peroxide March 1.

I feel that there has to be acknowledgement that the company had a sourced a local barge which required some modification (not a major re-fitting) and the barge would be ready by the end of this week (3 March, 2017).

I don't know if the tarps for treatment are pre-existing algae tarps or new tarps, but when told that they had tarps ready I assumed they were new and task-specific. I say this because Marine Harvest failed with their first tarps at Klemtu and had to sew modified tarps.

The manifold for the mixing tank is all customized work from Norway that needed a lead time – this was something ██████████ must have learned after January 26 and ██████████ confidence in having equipment close at hand based on his conversation with Karen ██████████

Dr. Ian Keith DVM
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s.19(1)

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Ian.Keith@dfo-mpo.gc.ca

From: Keith, Ian
Sent: Thursday, March 02, 2017 8:56 AM
To: Saksida, Sonja; Calla, Karen; Paylor, Adrienne; Klaver, March; Lavigne, Lauren
Cc: Lim, Susan
Subject: RE: draft BN for today

My edits and confirmation comments in text

Dr. Ian Keith DVM
Field Operations Veterinarian - Pacific Region
Fisheries and Oceans Canada | Pêches et Océans Canada
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Ian.Keith@dfo-mpo.gc.ca

From: Saksida, Sonja
Sent: Thursday, March 02, 2017 7:27 AM
To: Calla, Karen; Keith, Ian; Paylor, Adrienne; Klaver, March; Lavigne, Lauren
Cc: Lim, Susan
Subject: RE: draft BN for today

here you go - my comments.

From: Calla, Karen
Sent: Thursday, March 02, 2017 9:42 AM
To: Saksida, Sonja; Keith, Ian; Paylor, Adrienne; Klaver, March; Lavigne, Lauren
Cc: Lim, Susan
Subject: draft BN for today

I need to get this out today but I still have some gaps in the storyline,. Please have a look and send me your additions ASAP. For those of you at the session today – just come tell me verbally and I will add it in. Thanks,

Karen Calla
Director, Aquaculture Management Division, Pacific Region
Fisheries and Oceans Canada / Government of Canada
Karen.Calla@dfo-mpo.gc.ca / Tel: 604-666-7009

Directrice, Division de gestion de l'aquaculture, région du Pacifique
Pêches et Océans Canada / Gouvernement du Canada
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s.16(2)(c)



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2017-###-####

EKME #: #####

MEMORANDUM FOR THE REGIONAL DIRECTOR GENERAL

**SEA LICE EXCEEDANCES AT GRIEG SEAFOOD SITES
(FOR DECISION)**

SUMMARY OF ADVICE TO THE REGIONAL DIRECTOR GENERAL

chinook. (?? –should be Atlantic salmon?)

BACKGROUND

The department has a guideline of 3 motile lice per fish during the outmigration period for juvenile wild salmon. March 1 to June 30 of each year,

While not a condition of licence, all salmon farms are aware of their responsibility to meet this performance based standard. Two Nootka Island sites – Esperanza and Steamer Point near Tahsis are entering this period in exceedance of this standard.

There are no other active sites within the near vicinity of these 2 sites. And nNo other sites within this region (fish health zone 2.4) in this area are showing similar high levels of lice.

The two sites contain 28 cages in total with production up to 7,200 tonnes, between the two sites

Canada

.../2

Grieg's two sites have had very high sea lice counts since the fall. The department's veterinarians have been asking about their action plan for treatment since the first high counts were noted in the fall.

It was ~~DATE~~ October 26, 2016 when Grieg shared with DFO that SLICE is no longer effective at these sites. Increased t-Resistance to SLICE was confirmed by ~~found in bioassays~~ conducted by industry bioassays. However only in December 2016 did Grieg apply to BC for a permit to use Hydrogren Peroxide as an alternative method.

Comment [SS1]: Ian may have a more specific date

Comment [KI2]: Appropriate dates to use

To date Greig has received tarps for the treatment with peroxide and have received pesticide application training, but haven't yet received the modified locally sourced barge. The specialized equipment from Europe for application of the agent from the barge platform hasn't been manufactured as yet

They have been indicating that they planned to borrow equipment and get assistance crews from Marine Harvest to conduct the peroxide treatment. However, Marine Harvest's priorities are its own sites which need treatment so they have been unable to confirm an available time for Grieg's sites.

Grieg has now advised that they are trying to acquire their own treatment infrastructure as soon as possible but cannot provide a specific date.

Grieg received their pesticide use permit March 1. has their pesticide permit for peroxide?

Comment [KI3]: From Feb 28

Comment [SS4]: Not sure

Based on concerns expressed by DFO's veterinarians, Karen has been calling Grieg Seafood, weekly since February 1st seeking timelines and actions.

Letters

Sea lice counts at Steamer from February 22nd taken during a DFO audit showed 47.7 motile lice per fish - 15 times above threshold levels- with 20.1 of those adult females. Esperanza sea lice counts may be higher because it had higher levels of sea lice at the last industry counts.

Field Code Changed

Juvenile migrations (predominantly Chum salmon) in area of are likely to commence late March
early April.

STRATEGIC CONSIDERATIONS

Sea lice counts are published regularly to the DFO website. When these numbers are posted the Department can expect conservation groups to raise serious alarms with the impacts of high levels of lice throughout the wild juvenile salmon migration period, ATIPs, and subsequent media attention or legal challenges. This will reflect badly on the Department's regulatory role and on the salmon farming industry as a whole.

SCIENCE ADVICE

The 3 lice threshold was considered precautionary at the time it was developed. Science has been working to better understand the impact of sea lice on juvenile wild salmon survival.

INTERDEPARTMENTAL CONSULTATIONS

No interdepartmental consultations have occurred.

INDIGENOUS CONSULTATIONS

No Indigenous consultations have occurred.

EXTERNAL CONSULTATIONS

The Province of BC is aware of the pesticide use permit requested by Grieg but has not been included in sea lice management discussions.

ADVICE AND RECOMMENDATIONS TO THE REGIONAL DIRECTOR GENERAL

Comment [SS5]:

Field Code Changed

I concur:

I don't concur:

Rebecca Reid
Regional Director General
Pacific Region

Rebecca Reid
Regional Director General
Pacific Region

Attachment(s): (#) *(if applicable)*

- 1) Letter from DFO to Grieg Seafood on Feb 27, 2017
- 2) Letter from Grieg Seafood to DFO dated Feb 27, 2017 received Feb 28, 2017



Government of Canada
Fisheries and Oceans

Gouvernement du Canada
Pêches et Océans

CLASSIFICATION
GCCMS #: 20##-###-#####
EKME #: #####

To: Rebecca Reid
Pour:

Date:

Object: **SEA LICE EXCEEDANCES GRIEG SEAFOOD**

From / De: Andrew Thomson, Regional Director, Fisheries Management

Via: Karen Calla, Director, Aquaculture Management

Additional approvals:
Autre(s) approbation(s):

☒ Your Signature
Votre signature

☐ Information

☐ For Comments
Observation

☐ Material for the Minister
Documents pour le Ministre

Remarks: The Department has assessed this issue in full.
Remarques: ☒ It contains no reference to matters covered by the screen relating to J.D. Irving Limited.
☐ It contains matters referenced in the screen relating to J.D. Irving Limited, but in our view does not engage the screen.
☐ In our view, the screen relating to J.D. Irving Limited should be engaged.

This briefing note was developed in consultation with the following regions/sectors: N/A

Drafting Officer/ Rédacteur:

K. Calla/admin initials

Keith, Ian

From: Keith, Ian
Sent: March-03-17 11:38 AM
To: Paylor, Adrienne
Subject: FW: Esperanza veterinary assessment
Attachments: EsperanzaVet.pdf; K302 Steamer2014.pdf; M-692 Steamer2016.pdf

Follow Up Flag: Follow up
Flag Status: Completed

Dr. Ian Keith DVM
Field Operations Veterinarian - Pacific Region
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Ian.Keith@dfo-mpo.gc.ca

From: [REDACTED]
Sent: Thursday, December 01, 2016 3:53 PM
To: Saksida, Sonja; Keith, Ian
Subject: Esperanza veterinary assessment

Hello, attached is my Veterinary assessment document and the supporting bioassays. If there is any further information you would like let me know. As far as the application process goes, we are getting all the information together and hope to be submitting the application to the ministry of Environment early next week. I realize DFO is not the controlling body in this matter. Thank you , I appreciate your assistance.

Cheers

[REDACTED]

Grieg Seafood BC Ltd.
106 - 1180 Ironwood St, Campbell River BC, V9W 5P7
(250) 236-0838 Ext [REDACTED]
[REDACTED]
Web www.griegseafoodcanada.com

s.16(2)(c)

s.19(1)

**Pages 141 to / à 147
are withheld pursuant to section
sont retenues en vertu de l'article**

20(1)(b)

**of the Access to Information Act
de la Loi sur l'accès à l'information**

Jones, Simon

From: Keith, Ian
Sent: Wednesday, March 15, 2017 1:50 PM
To: Jones, Simon
Cc: Sandberg, Krista
Subject: SLICE use
Attachments: Drug use Graphs 2016 Krista.xlsx

Follow Up Flag: Follow up
Flag Status: Flagged

Hi Simon,

Please see the 'data' worksheet which includes grams of EB through 2016. (Krista doesn't have the 2016 harvest to produce the 2016 figure as yet.) I think that she and Sonja have sufficient confidence in the SLICE use numbers. Regarding the project, I was keen that there be improved communication of representation of abundance, and distribution of SL in space and time. I was also interested in communicating the changes in abundance over time, from 1st year of production forward such as for Klemtu, and the longer term cycles that you had alluded to in the past. I am apt to raise concern when the GIS people around me talk about spatial analysis because in the sea lice world the assumption is that the rigours of epidemiology apply.

Ian

Ps: [REDACTED]

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s.16(2)(c)

s.19(1)

s.21(1)(b)

Source:	BCSFA	Carmen Matthews BCMAgr	% by Species		GRAPH				GRAPH				GRAPH					
			Pacific	Atlantic	Calculated ALL salmon round live wt.; no blood	Total active antibiotic kg (Dew/tn Rx audits)	Total active Ab Pacific	Total active Ab Atlantic	GRAPH Active antibiotic both salmon (2008 audit)	Active Ab by Pacific	Active Ab by Atlantic	Medicated Feed	Total Estimated Feed	Active Ivermectin	Grams Active Iver per Mt fish	Active Em Benz Rx'd (EB)	Grams active EB per MT fish (Atl&Pac only)	
																		round MT
Units:	Dressed MT	Round Wt (MT)																
Year																		
1995	23800	27,370	32%	68%	18,612	12477	8758	18,612	8600.00	2239.00	456	982	120	1175	56000	na		N/A
1996	24000	27,600	31%	69%	19,044	9278	8556	19,044	6136.00	3142.00	336	717	165	1224	58285	553		N/A
1997	32500	37,375	19%	81%	30,274	19282	7101	30,274	8800.00	10482.00	516	1239	346	1999	71000	437	0.012	N/A
1998	38000	43,700	15%	85%	37,145	16732	5555	37,145	6732.00	5611.00	383	1697	151	1990	74827	400	0.009	N/A
1999		43,100	21%	77%	38,000	12906	10,100	38,000	4956.00	7950.00	263	491	209	1471		90	0.002	N/A
2000	48,700* (bofils Rnd)	49,400	20%	80%	39,300	16880	10,100	39,300	8546.19	8326.40	342	846	212			250	0.005	0.062
2001		67,600	14%	86%	58,000	11128	9,600	58,000	5895.00	5233.11	165	614	90			8.4	0.001	0.074
2002		85,400	15	85	72,590	20695	12810	72,590			242	0	0					0.104
2003		72,700	20%	80%	58100	24695		58100			350	0						0.101
2004	Magr	61,800	20%	80%	49440	20582		49440	14821.00	6000.00	337		121					0.127
2005	Magr	70,590	24%	76%	53,785	13462	16,805	53,785	7923.00	8119.00	227	471	151					0.208
2006	78,000 (YIR)	78,000	9%	91%	74,416	8295	6,980	74,416	2688.00	5590.00	106	385	75					0.345
2007	Magr	78,886	7%	93%	73,333	8689	5,553	73,333	2889.00	5699.00	109	520	78					0.263
2008	Magr	81,400	5%	95%	77,200		4,200	77,200	1726.00	3832.00	68	411	50					0.214
2009	Magr	76,300	5%	95%	72,700		3,600	72,700	2214.89	2863.49	67	615	39					0.167
2010	Magr	79,000									73							0.266
2011	Magr	83,000									42							0.263
2012	Magr	74,000									69							0.186
2013	Magr	77,500	12%	88%	68,300	4097.69	9,200	68,300	1477.91	2619.78	53	161	38					0.107
2014	Magr	59,700	13%	87%	52,200		7,500	52,200										0.122
2013	DFO Asst/MBC	77,263	12%	88%	68,327	6172.81	8,936	68,327	2008.50	4164.31	80	225	61					0.226
2014	DFO Asst/MBC	62,493	13%	87%	54,254	5484.30	8,238	54,254	2128.22	3356.08	88	258	62					0.332
2015	DFO Asst/MBC	92,416	3%	97%	89,502	14368.82	2,915	89,502	0	14368.82	155	0	161					0.334

Grams active antibiotic per Atl&Pac fish produced

Grams/MT Round Wt

Salmon

Year

1995

1996

1997

1998

1999

2000

2001

2002

2003

2004

2005

2006

2007

2008

2009

2010

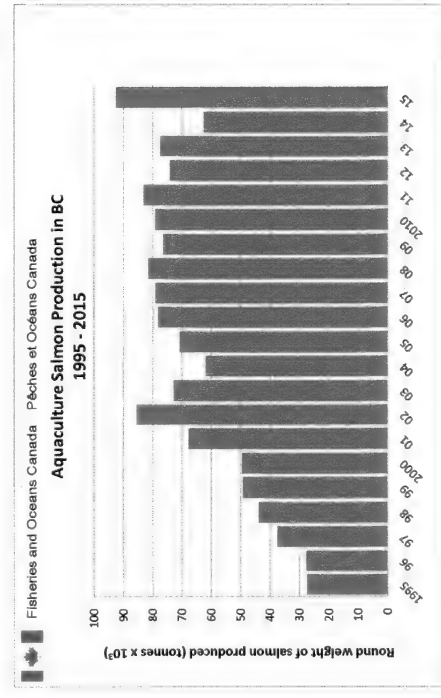
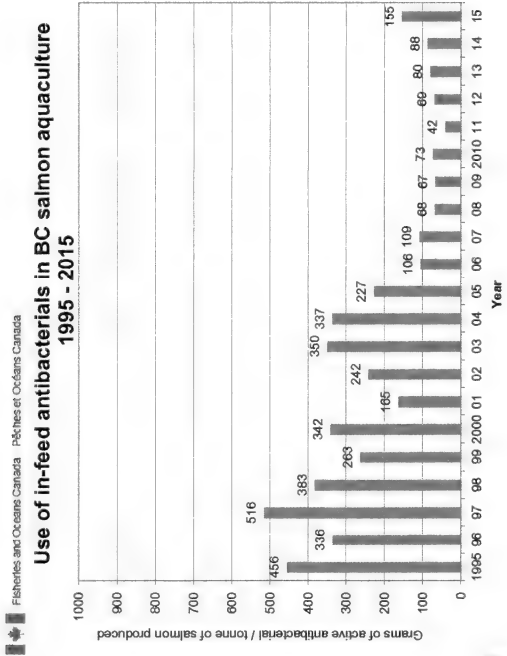
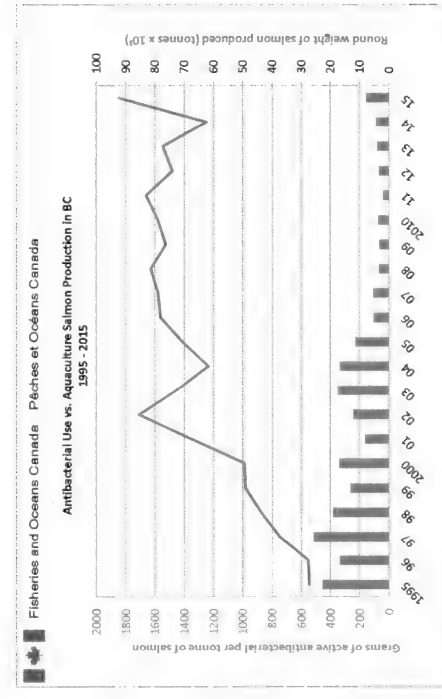
2011

2012

2013

2014

2015

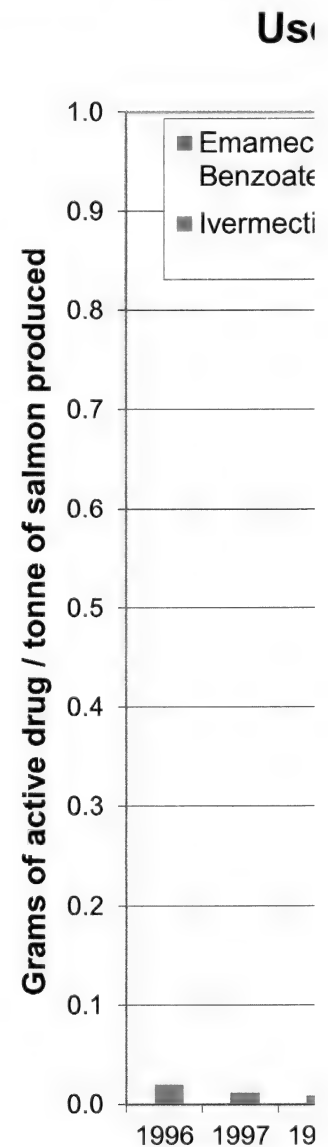




Fisheries and Oceans Canada

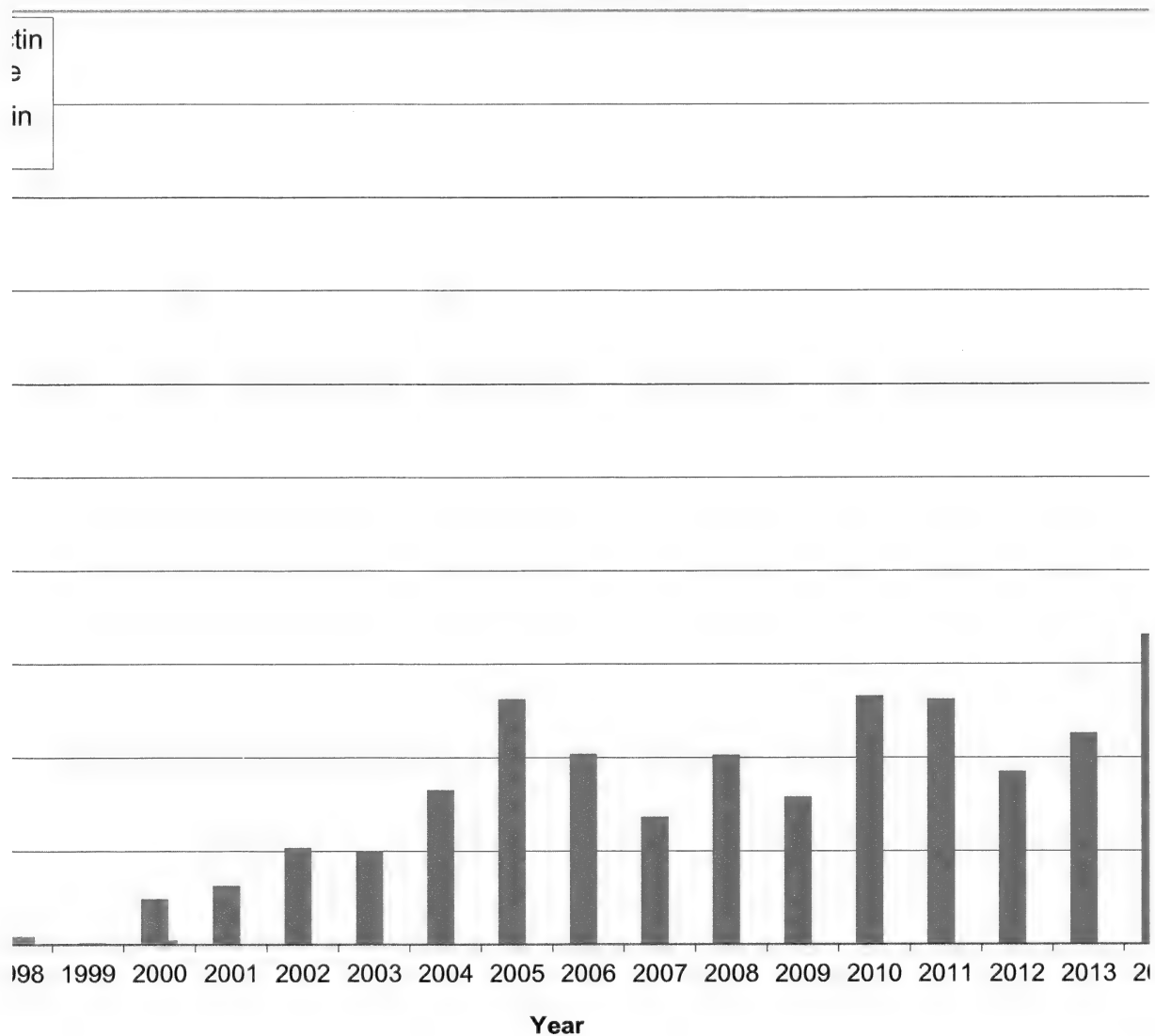
Year	Ivermectin	Emamectin Benzoate
1996	0.020	0
1997	0.012	0
1998	0.009	0
1999	0.002	0
2000	0.005	0.049
2001	0.0001	0.063
2002	0	0.104
2003	0	0.101
2004	0	0.166
2005	0	0.263
2006		0.204
2007		0.137
2008		0.203
2009		0.159
2010		0.2664592
2011		0.2631675
2012		0.1859831
2013		0.2261488
2014		0.3319423
2015		0.3344425

Grams active EB per Atl&Pac fish produced



Oceans Canada Pêches et Océans Canada

Use of in-feed anti-lice therapeutants in BC salmon aquaculture 1996 - 2015



e

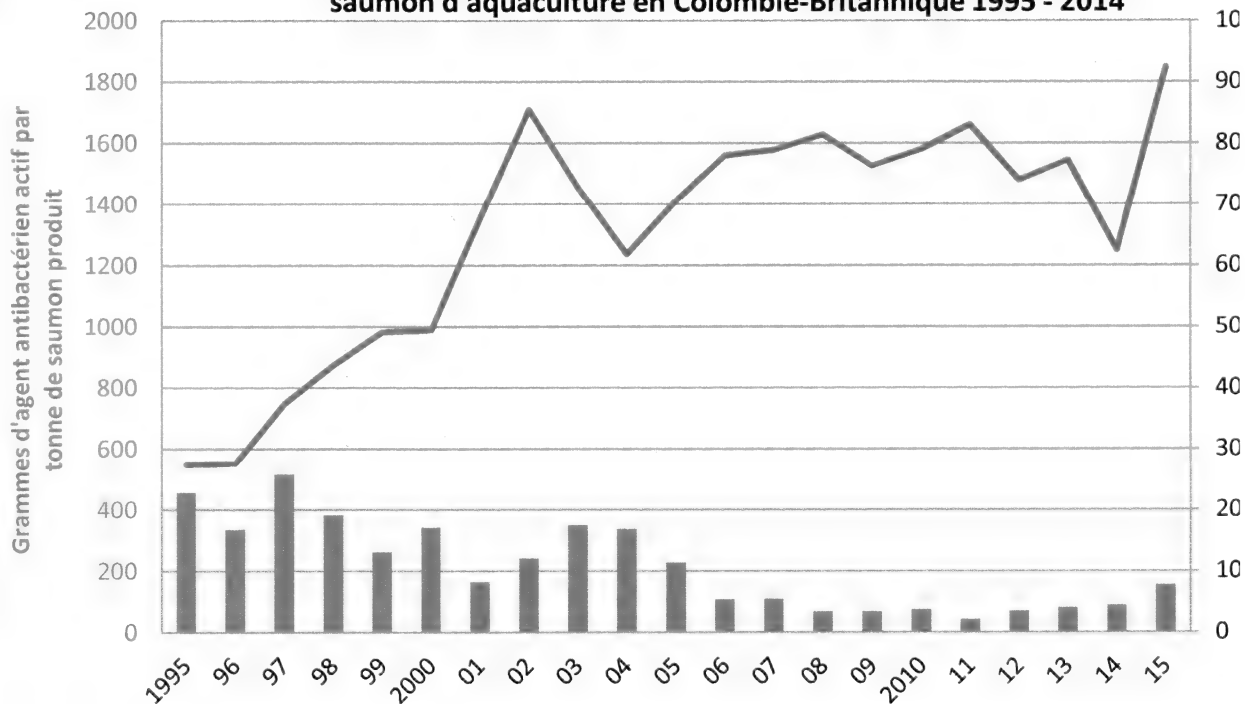




Pêches et Océans
Canada

Fisheries and Oceans
Canada

Utilisation des agents antibactériens contre production de saumon d'aquaculture en Colombie-Britannique 1995 - 2014

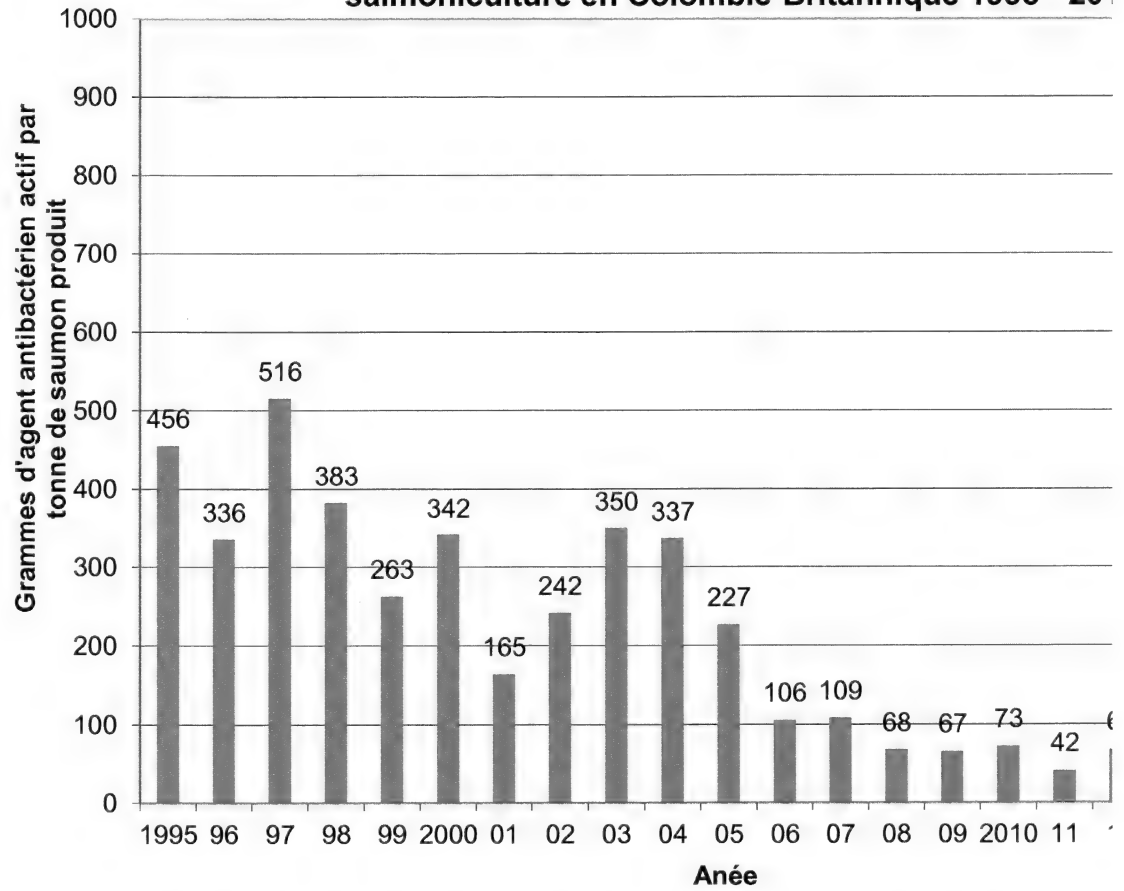




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Canada

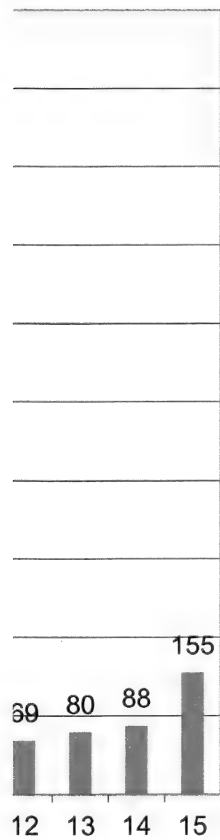
Fisheries and Oceans
Canada

Utilisation des agents antibactériens incorporés dans les aliments salmoniculture en Colombie-Britannique 1995 - 2011



Poids brut de saumon produit (tonnes)

ients dans la 15

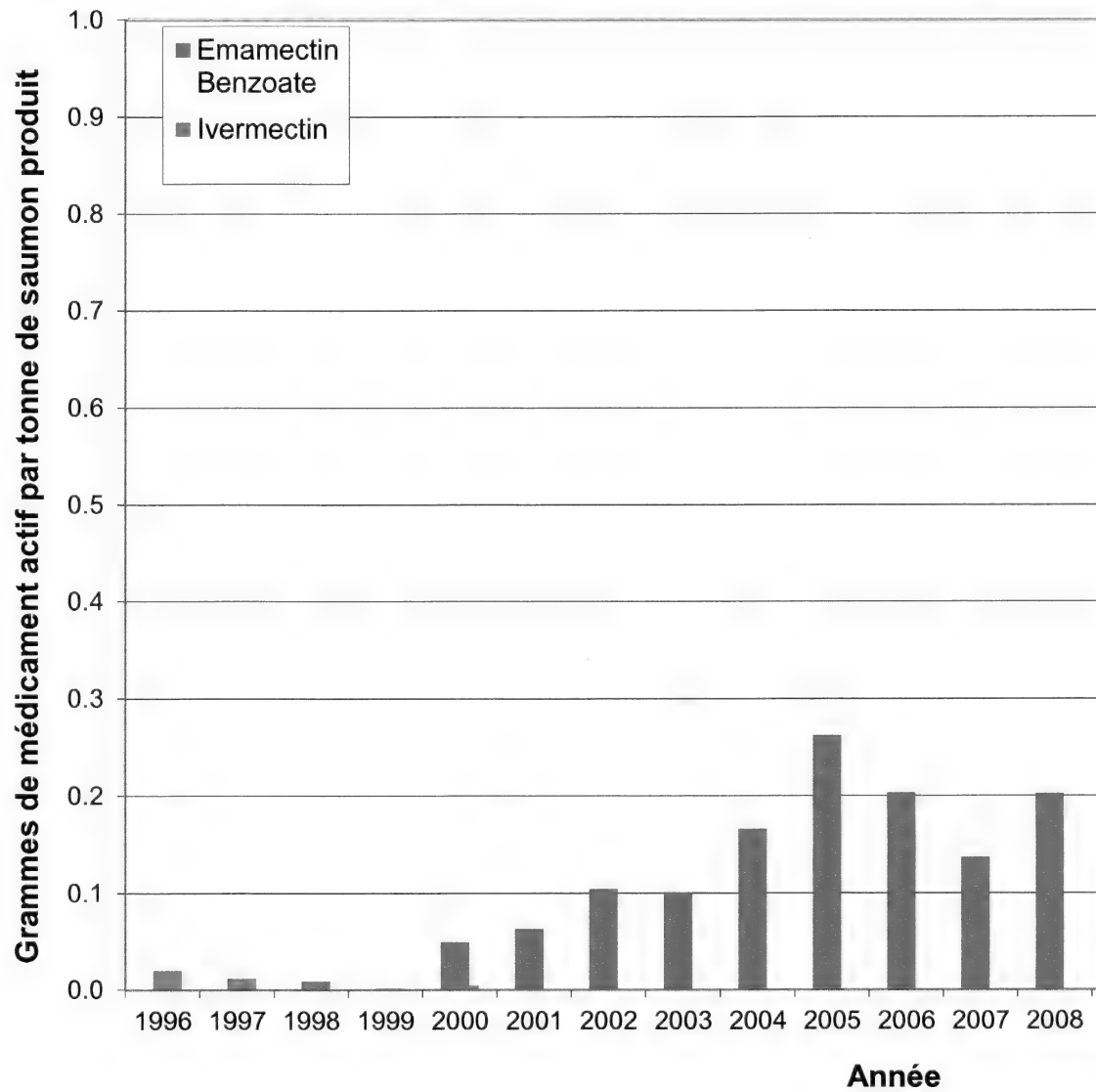




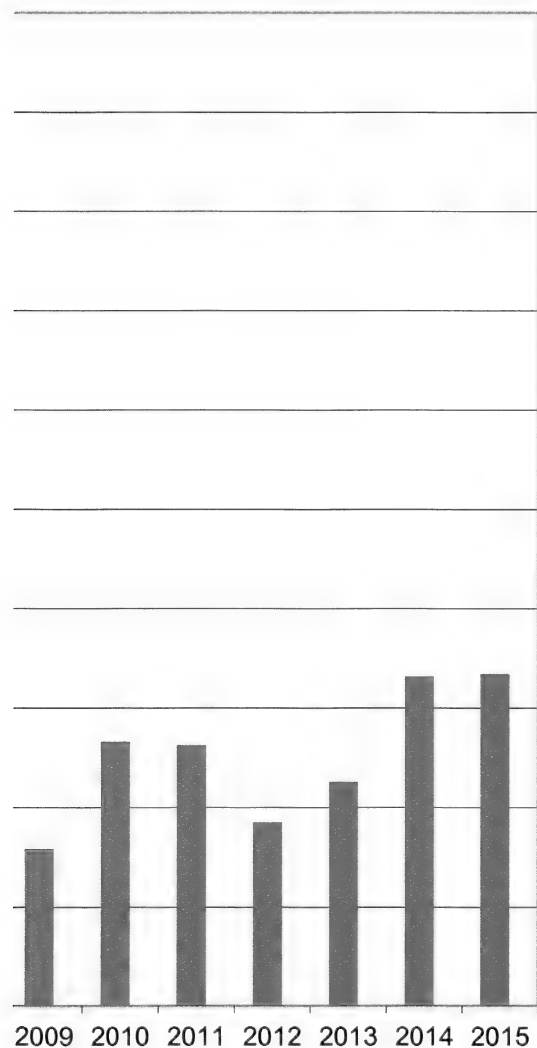
Pêches et Océans
Canada

Fisheries and Oceans
Canada

Utilisation des agents thérapeutiques incorporés contre le pou dans la salmoniculture en Colom



**dans les aliments afin de lutter
ibie-Britannique 1996 - 2014**



Jones, Simon

From: Keith, Ian
Sent: Wednesday, March 15, 2017 3:21 PM
To: Jones, Simon
Subject: RE: SLICE use

Follow Up Flag: Follow up
Flag Status: Flagged

I know of no prescribing of EB for Pacific salmon.

The data worksheet would allow estimates of Atlantic salmon only; sorry to say that I had to check, that I didn't know that SLICE use would have as its denominator Pacific salmon plus Atlantic salmon but this would allow comparison with the antimicrobial use graph and the story of drug use per tonne production.

With Sechelt becoming exclusively Atlantic salmon production, there shouldn't be much change in the shape of the curve; however in August 2015 Atlantic salmon in Sechelt Inlet required treatment. ([REDACTED] said that the wild fish were milling around waiting for the water levels in the river near the farm to rise, so not a consequence of changes in the Inlet.

Dr. Ian Keith DVM
Field Operations Veterinarian - Pacific Region
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Fisheries Management
Aquaculture Management Division | Gestion de l'aquaculture
Aquaculture Environmental Operations - Fish Health
#103 - 2435 Mansfield Drive
Courtenay, British Columbia V9N 2M2
Telephone | Téléphone: 250-703-0917
Mobile | Portable: [REDACTED]
Fax | Télécopieur: 250-703-0921
Ian.Keith@dfo-mpo.gc.ca

From: Jones, Simon
Sent: Wednesday, March 15, 2017 2:00 PM
To: Keith, Ian
Cc: Sandberg, Krista
Subject: RE: SLICE use

Hi Ian,

[REDACTED]

Thanks for providing this so quickly – it helps a lot. Regarding the data, I doubt there was much if any EMB prescribed for treatment of lice on Pacific salmon, yet the data is presented per MT of both Atlantic and Pacific salmon. Is there not a continuous series of Atlantic salmon production during this interval? Let me know if this is not correct, i.e., that EMB was prescribed in Pacific salmon too.

Thanks,

Simon

s.16(2)(c)

s.19(1)

s.21(1)(b)

From: Keith, Ian
Sent: March-15-17 1:50 PM
To: Jones, Simon
Cc: Sandberg, Krista
Subject: SLICE use

Hi Simon,

Please see the 'data' worksheet which includes grams of EB through 2016. (Krista doesn't have the 2016 harvest to produce the 2016 figure as yet.) I think that she and Sonja have sufficient confidence in the SLICE use numbers. Regarding the project, I was keen that there be improved communication of representation of abundance, and distribution of SL in space and time. I was also interested in communicating the changes in abundance over time, from 1st year of production forward such as for Klemtu, and the longer term cycles that you had alluded to in the past. I am apt to raise concern when the GIS people around me talk about spatial analysis because in the sea lice world the assumption is that the rigours of epidemiology apply.

Ian

Ps: [REDACTED]

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Ian.Keith@dfo-mpo.gc.ca

s.16(2)(c)

s.19(1)

s.21(1)(b)

Sandberg, Krista

From: Sandberg, Krista
Sent: March-16-17 2:44 PM
To: Jones, Simon, Keith, Ian
Subject: RE: SLICE use

Hi Simon,

I'm not sure if Ian answered this or not, but you are correct. I believe the graph shows *Slice in relation to both Atlantic and Pacific salmon* because it was a public report and the idea was to communicate the usage in relation to all salmon produced, regardless of which species was treated. That being said, the "data" tab in the file shows production broken down by species (columns F&G, with missing data from 2010-2012 that I could estimate if needed). There is also a calculation for grams/atlantic (column U).

Krista.

Krista Sandberg

telephone: 250 286 5835
cellular: [REDACTED]

téléphone: 250 286 5835
téléphone portable: [REDACTED]

From: Jones, Simon
Sent: Wednesday, March 15, 2017 2:00 PM
To: Keith, Ian
Cc: Sandberg, Krista
Subject: RE: SLICE use

Hi Ian,

[REDACTED]

Thanks for providing this so quickly – it helps a lot. Regarding the data, I doubt there was much if any EMB prescribed for treatment of lice on Pacific salmon, yet the data is presented per MT of both Atlantic and Pacific salmon. Is there not a continuous series of Atlantic salmon production during this interval? Let me know if this is not correct, i.e., that EMB was prescribed in Pacific salmon too.

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Simon

s.16(2)(c)

s.19(1)

From: Keith, Ian
Sent: March-15-17 1:50 PM
To: Jones, Simon
Cc: Sandberg, Krista
Subject: SLICE use

s.21(1)(b)

Hi Simon,

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Ps: [REDACTED]

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**FISHERIES AND OCEANS CANADA
FINFISH AQUACULTURE INDUSTRY ADVISORY PANEL (FAIAP)**

April 21, 2017 – 9:00 am – 12:00 pm

Boardroom A, DFO Regional Headquarters, 401 Burrard Street, Vancouver BC

Call-in number: 1-877-413-4781 / Passcode: [REDACTED]

MODERATOR PASSCODE: [REDACTED]

ANNOTATED AGENDA

Chair: K. Calla

Participants: Industry:

[REDACTED] (BCSFA), [REDACTED] (Marine Harvest),
(Grieg Seafood), [REDACTED] (Creative Salmon), [REDACTED] (Skretting),
[REDACTED] (Cermaq), [REDACTED] (Taplow Feeds), [REDACTED] (Cargill),
[REDACTED] (Cermaq).

Province of BC:

Lesley Fettes, Myron Roth, Rudi Mayser

DFO:

Shirley Choi, Karen Calla, Bernie Taekema, March Klaver

Secretariat: Shirley Choi

- 1. Welcome, Introductions and Overview of the Agenda (Karen Calla)** s.16(2)(c)
- 2. Wild Salmon Policy Implementation (TBD) (30 minutes)** s.19(1)
- 3. Action items review from Jan 18, 2017 FAIAP Meeting (Karen Calla)**
 - Accept January 18, 2017 FAIAP meeting minutes
 - Review action items from January 18, 2017 FAIAP meeting (see annotated action item document)

4. Aquaculture Program Updates (Karen Calla)

Applications: Status and number of current applications (Bernie Taekema)

A table of current aquaculture applications was distributed to FAIAP meeting attendees.

Strategic Working Group update (Lauren Lavigne)

Two meetings since October 13 FAIAP meeting (February 10, 2017, April 7, 2017) and topics discussed (latest updates included) are as follows:

- SWG Terms of Reference
- Integrated Pest Management Approach (see agenda below)
- Use of cleaner fish
(See attachment)

- Biosecurity zones Info coming from Lauren
- Fallowing
 - This item was given to the FHAC but that group is now not moving ahead, item to be moved to SWG
 - The SWG has discussed fallowing and the potential to change current policy (previously proposed by DFO)
 - SWG agrees there are other considerations:
 - NSERC proposal – if approved, is a 5 year project on Fish Health including: modelling (BKD, sea lice and Rickettsia); genomics and policy
 - CSAS question on fallowing has been initiated but needs refinement – currently on hold
 - SWG will pause work on this item to see how these other items advance
- Update on fate of SLICE science review discussion
Priority to study as it is a critical tool integrated pest management. No highest priority in 2017. ADCRP is the best avenue for a study on SLICE to occur. DFO has met with NHQ Science to discuss and will get an update prior to next meeting.
- Public Reporting
Note that the 2015 - 2016 aquaculture report completed. Sent out as attachment.

Cetacean interactions and entanglement bulletin and humpback whale behaviour (Fish farm/marine mammal interactions) (Karen)

See attachment in binder

Performance based regulation (Karen)

See attachment in binder

▪ ***Clean Technology Position (Karen)***

In the latest budget the Federal government announced funding for **Clean Technology in the Natural Resources Sectors, including Fisheries**: supporting research, development and adoption of clean technology to boost the growth of Canada's natural resources sectors; and the **Oceans Protection Plan**: the \$1.5 billion initiative which will improve and support marine safety and responsible shipping, protect Canada's marine environment, and offer new possibilities for Indigenous and coastal communities. A position to support the clean technology initiative will be staffed in RHQ.

Budget 2017 proposes to provide \$200 million over four years, starting in 2017–18, to Natural Resources Canada, Agriculture and Agri-Food Canada and Fisheries and Oceans Canada. Technologies at varying stages of maturity will be eligible, and eligible recipients will include industry, academia, federal laboratories and other research organizations.

5. Integrated Pest Management

→ See attached document developed by SWG

6. BCSFA Update

7. Roundtable

8. Closing and Adjournment

- Set next meeting date.
- Next regular quarterly occurrence of meeting would take place at end of July 2017.

Paylor, Adrienne

From: Paylor, Adrienne
Sent: May-15-17 3:39 PM
To: Calla, Karen; Lavigne, Lauren; Klaver, March
Subject: FW: CRWG Call for Friday Oct 14
Attachments: Science issues for DFO call Oct 14_16 ss DRAFT.docx

This was AEO's draft response to the NGO science issues that I passed to Jon but I'm not sure what actually got send back to the NGO's.

Adrienne

From: Saksida, Sonja
Sent: Wednesday, October 19, 2016 9:55 AM
To: Paylor, Adrienne; Keith, Ian
Subject: RE: CRWG Call for Friday Oct 14

Here are some comments to the document
Ian please add and revise.
S

From: Paylor, Adrienne
Sent: Wednesday, October 19, 2016 9:56 AM
To: Saksida, Sonja
Subject: Fw: CRWG Call for Friday Oct 14

What the NGO's want more science on from last Fridays meeting.

Sent from my BlackBerry 10 smartphone on the Rogers network.

From: Calla, Karen <Karen.Calla@dfo-mpo.gc.ca>
Sent: Monday, October 17, 2016 2:08 PM
To: Paylor, Adrienne; Jepps, Shelley; Klaver, March
Subject: FW: CRWG Call for Friday Oct 14

fyi

From: [REDACTED]
Sent: Monday, October 17, 2016 1:43 PM
To: Calla, Karen <Karen.Calla@dfo-mpo.gc.ca>; McNabb, Melanie <Melanie.McNabb@dfo-mpo.gc.ca>; Lavigne, Lauren <Lauren.Lavigne@dfo-mpo.gc.ca>; Chamberlain, Jon <Jon.Chamberlain@dfo-mpo.gc.ca>
Cc: [REDACTED]

Subject: RE: CRWG Call for Friday Oct 14

From our call last week, here's that Science Priorities document I was reading from.

Thanks.

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s.19(1)

No further information has been removed or severed from this page

Key risks of salmon farming to wild fish

Risk assessments are needed on:

- Pathogens – IHN, ISA, PRV-HSMI, Salmon Leukemia, BKD, Furunculosis, Vibrio
- Sea lice – Caligus, Lepeophtheirus
- Cumulative and interactive effects of sea lice, bacteria and viruses

Knowledge gaps and research needed

-Accelerated Risk Assessments on all parasites and pathogens

-Learnings gleaned from collaborative Broughton Area Research should be tested in other areas (e.g., early Slice treatment, following migration routes) and how these studies have been applied (or not) in different farming areas.

- The data that has been assembled through the sea lice monitoring and audit programs have shown that there are a number of factors that vary among the different areas this includes environment (temperature, salinity and hydrographic flow differences), ecology (different wild salmon species predominance and migration patterns) and different sea lice infection patterns although in most cases the pattern of elevated lice in the fall in association to the return of the wild adult salmon is consistent. There have also been difference in treatment requirements and efficacy.
- As a start an internal State of Knowledge paper was prepared last year providing an evaluation of situation over the last 15 years. In this report – options were suggested as to how the program to be modified. These however are not considered to be an exhaustive list.
- The goal would be to have the data collected to this point to be reviewed and analysed by DFO science to assess whether one blanket regulation across all areas is the most appropriate management tool and if not to help develop a program that better meets the objectives of the program.

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-Lice numbers on farms should be examined at the area level. The sea louse trigger is currently based on the average number of lice per fish; however it should be based on total abundance of lice at the farm and area level. -Pathogens and parasites should be managed as a density-dependent factor. How can this be integrated into management?

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- This has been addressed in the State of Knowledge document to needs to be reviewed when re-evaluating the program
- In addition to the State of Knowledge document, DFO has been working on a draft Integrated Pest management document (IPM) specifically for sea lice management. Some of the elements to be addressed include coordinated management areas and the ability of rotating treatments to ensure products remain effective.

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-Lice sampling on wild fish should occur across all farming areas, not just the Broughton (e.g., DI, WCVI, Central Coast, etc.)

-Resistance to therapeutants in BC – (e.g., Slice, H₂S₂H₂O₂) Magnitude of forage fish being eaten by farm fish, effects of herring feeding on farm feed – ATIP indications of potential resistance Cermaq, What is going on?

- Part of a good and effective program for management of pathogens includes the ability to have more than one product when the need to treat arises. This is to ensure that medicant remain effective.
- The problem with BC is that there has been a fairly low mandatory treatment threshold that likely has resulted in more treatments being required than necessary. This may have likely resulted in unnecessary treatments.
- Another issue is treatment of large sized fish. The current practice in BC is to not grade fish in seawater – some companies do not do any weight sampling either. This along with certain feeding practices (pulse feeding rather than meals) maybe resulting in considerable size variation in the pens. Companies have adopted a system of grade harvesting – meaning fish are seined up but there are gaps in the seine which allow the smaller fish to escape leaving the large fish in the seine to be harvested. The results in a pen of fish being seined a number of times before the pen is emptied.
- There is a concern that size variation within the pens however creates a significant problem if these fish have to be treated for either sea lice (due to regulations) or other diseases such as SRS. Treatments are provided in feed and calculation is based on the average weight and number of fish and feeding rate. If the fish are not of uniform weight the result is likely that some fish will be overdosed and some under. Pathogens on or in fish that are underdosed risk the chance of developing resistance to the therapeutant – with respect to Sealice that is SLICE.
- In BC – H₂O₂ is now available through and Emergency drug release. This product is a bath treatment and therefore the size variation is not an issue. The ability of rotating products – using SLICE on the small fish and H₂O₂ could greatly reduce any chance of resistance occurring for SLICE
- Problems in SLICE tolerance has been seen in both Klemtu and Quatsino – both Marine Harvest farms not Cermaq.
 - In both areas management has been modified to address the potential problem
 - In Quatsino – all farms were emptied since early summer and the plan is to restock the farms this fall and operate the entire area as a single year area and coordinate treatments as well as rotating therepeutants.
 - In Klemtu a similar change in management has started with but at a smaller scale with adjacent farms having same year class populations. To date the program appears to be successful and it appear that the SLICE issues may have resolved.

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-Herring feeding on fish feed. What the implications of herring being attracted to open nets and ingesting pesticides antibiotics drugs that's milled into the feed?

- This could be a study.

ISAV

There are several datasets reporting ISAV results in BC that must be reconciled in a scientific manner to ensure this virus is not replicating in the aquaculture environment and spilling over into wild salmon habitat. Examples include:

- A paper in Virology Journal (that survived attempts by DFO and BC to have it retracted) reports on partial ISA virus sequences that match the EU strains identified as HPR0, HPR5 and HPR7bⁱ.
- Dr. Kristi Miller's lab reports ISAV findings in farmed Chinook salmon from Creative Salmonⁱⁱ, which were apparently reported to the CFIAⁱⁱⁱ
 - This was confirmed to be a false positive. Here tests have been modified to address the problems with the test.
- Dr. Kristi Miller's lab ISAV findings in Fraser River sockeye salmon (Chilko, SOG, Cultus)^{iv}
 - Again determined to be false positive.
- CFIA ISAV surveillance reporting ISAV does not occur in BC, but does not identify what PCR test they used.^v
 - ISO certified DFO Lab in Moncton is used to test for ISAV. They use a test validated to OIE standards to detect both the virulent and non-virulent strains of ISAV.
- Oct. 5, 2016 letter from Minister LeBlanc stating: "Through discussions with the CFIA, the methodology used by Dr. Miller-Saunders has since been refined to improve the program's detection accuracy. Using the refined criteria, Dr. Miller-Saunders has not submitted any suspicious detections to date."

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Is there a technical reason for the differences in results? If there are new methods incapable of finding ISAV in BC, they must be detailed and explanation offered as to how they are better than the tests previously used that detected ISAV or ISA-like virus in BC in several labs.

- Good Laboratory practices are essential when doing diagnostics using highly sensitive molecular tests such as PCF which require a high level of due diligence to avoid cross contamination. ISA is part of the standard tests used in the DFO audit program. The PCR test is done at the BC Animal Health Laboratory in Abbotsford it is a certified laboratory using a validated test.

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Mortality Related Signature

A significant likely contributor to the Fraser River Sockeye Salmon collapse is the 40-90% in-river prespaw mortality^{vi,vii}. After intense effort to discover the cause of this mortality, a distinctive genomic profile, named 'the mortality related signature,' was identified exclusively in the Fraser River Sockeye Salmon that die in the river before spawning^{iv}. Among the genes up-regulated in this genomic profile, are genes linked to viral activity and leukemia^{iv}.

- In the early 1990s DFO discovered and named the “salmon leukemia virus” in 96% of Chinook salmon farms in the Discovery Islands (and Broughton). Dr. Gary Marty continued to report the diagnostic lesions for this disease in farm salmon in the Discovery Islands. This virus was found to spread and infect 100% of sockeye exposed to it^{viii}
 - There is still a lot of debate in what causes Plasmacytoid Leukemia or Marine Anemia in Chinook salmon. The clinical signs include pale gills, swollen kidney and spleen.
 - Two agents a microsporidian and a virus have been suggested to be the cause.
 - Not sure what the mortality related signature so until that is determined this is just speculation.

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We cannot evaluate the impact of salmon farms on wild BC salmon without knowing what virus was found associated with the Mortality Related Signature.

Piscirickettsia salmonis

Piscirickettsia salmonis is a significant salmon pathogen in the global salmon farming industry, particularly in Chile. Research suggests a strain found in Canada is related to a Scottish strain^{ix}. The bacteria has been detected in highly jaundice pink salmon in the lower Fraser River (pers com.) May 31, 2016 an international meeting on *Piscirickettsia salmonis* hosted by the BC Salmon Farmers was held in Campbell River^x.

A DFO update on this pathogen would be useful as well as surveillance updates in BC wild salmonids.

Furunculosis

Reporting on efficacy of furunculosis vaccines used in BC. Is this bacterial disease on the rise in BC farmed salmon hatcheries?

- There is no evidence to suggest that there is a rise of furunculosis in hatcheries.
- The Vaccine is very effective against furunculosis and remains so. The problem occurs if the fish are exposed to the bacteria before they can be vaccinated or just after before immunity has developed.
- There are 2 hatcheries that have had issues with furunculosis –
- received water from wells but based on temperature variations these wells are likely connected to surface water (leaky aquafor). also has shallow wells or surface water. Both facilities have invested extensively to water treatment to try to prevent the bacteria coming in from the environment.
 - In the event that the system fails there are procedures to manage the infection including treatment with antibiotics and if need be culling.

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HSMI

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Since preliminary reporting on this disease (i.e., Kristi Miller and [REDACTED] press conference) in May 2016 [REDACTED]^{xi} there has been no further information on surveillance for HSMI in BC salmon farms. The disease is now reported in Chile as associated with piscine reovirus^{xii}. If HSMI preliminary results have been reported in ½ BC farms examined for the disease, how widespread is the disease?

In the video “Farmed salmon deaths exposed”^{xiii} a new age-class of Atlantic appears lethargic and dying in the Venture Point farm.

- Venture Point was undergoing a serious low DO event when this film was made. This has been confirmed though our surveillance and fish health group.

There needs to be widespread surveillance reporting for HSMI and PRV in moribund farm salmon and PRV in wild salmon from a range of exposures to farm salmon. Looking for HSMI in wild salmon is probably futile as it is severe heart disease as impacted fish would likely be taken by predators.

- Research is on going in BC with regards to PRV and HSMI as the science is completed. We are being updated as the results come in and will consider adjusting the program if warranted.

How is new science integrated into management of farms? How is non-DFO science considered, weighed and integrated into management decisions? Why does there appear to be selectivity within DFO towards favouring industry/government science and pro-industry conclusions?

- The important element in science is the ability to repeat the work and find the same results. Quality assurance is essential for science to progress and be useful.
- DFO management relies on DFO science to inform.
- DFO scientists work closely with their peers and other fish health experts nationally and internationally to validate their work and ensure that their findings are repeatable – often with the same tissues that were collected and tested.
- Honestly the research that these guys are referring to does not follow the same stringent protocols – samples cannot be retested, there has been questions about the QA of the labs tested and often a number of papers are published with the same dataset by the same authors with doesn’t actually add to the burden of proof.

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ⁱ <https://virologyj.biomedcentral.com/articles/10.1186/s12985-015-0459-1>

ⁱⁱ Cohen exhibit 2053 – 136a

ⁱⁱⁱ Cohen exhibit 2055

^{iv} Cohen exhibit 2060

^v <http://www.inspection.gc.ca/animals/aquatic-animals/diseases/reportable/isa/epidemiological-evaluation-farmed-salmon/eng/1410060765809/1410060766512>

^{vi} Hinch 2009

^{vii} Miller et al., 2011

s.19(1)

s.20(1)(b)

s.21(1)(b)

viii Kent and Dawe 1993

ix <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC444838/>

x <http://www.cahs-bc.ca/piscirickettsia-salmonis-srs-workshop>

xi [https://www.cermaq.com/wps/wcm/connect/msca-content-en/mainstream-](https://www.cermaq.com/wps/wcm/connect/msca-content-en/mainstream-canada/news/a+group+of+scientists+are+reporting+potential+findings+of+a+case+of+hsmi+in+bc)

[canada/news/a+group+of+scientists+are+reporting+potential+findings+of+a+case+of+hsmi+in+bc](https://www.cermaq.com/wps/wcm/connect/msca-content-en/mainstream-canada/news/a+group+of+scientists+are+reporting+potential+findings+of+a+case+of+hsmi+in+bc)

xii <https://www.ncbi.nlm.nih.gov/pubmed/27296722>

xiii <https://www.youtube.com/watch?v=lrwIFkeibe8&feature=youtu.be>

No information has been removed or severed from this page

Sandberg, Krista

From: Sandberg, Krista
Sent: May-25-17 12:53 PM
To: Charbonneau, Michelle; Keith, Ian
Subject: RE: Cermaq Ongoing/upcoming SLICE treatments in Zone 2.3

Thanks, Michelle. Good catch.

I will follow up [REDACTED] He sent a mass email for the rest of those sites but Saranac was not included.

Krista Sandberg

telephone: 250 286 5835

téléphone: 250 286 5835

cellular: [REDACTED]

téléphone portable: [REDACTED]

From: Charbonneau, Michelle
Sent: Thursday, May 25, 2017, 12:49 PM
To: Sandberg, Krista; Keith, Ian
Subject: Cermaq Ongoing/upcoming SLICE treatments in Zone 2.3

Thanks for that spreadsheet Krista. I've noticed that Cermaq hasn't reported Slice usage at Saranac May 13-19th 2017.
Please see the email below [REDACTED]

Cheers,

Michelle Charbonneau

Michelle.Charbonneau@dfo-mpo.gc.ca

Telephone | Téléphone 250-895-1724

From: [REDACTED]
Sent: Thursday, May 25, 2017 11:21 AM
To: Charbonneau, Michelle
Subject: Ongoing/upcoming SLICE treatments and biosecurity order for DFO audits

Hi Michelle,

As requested, here are the SLICE treatments occurring/upcoming:

Binns: Treated pens 2, 3, 4, 6, 8 April 7th-13th

Mussel Rock: Treated all pens May 19th-25th

Saranac: Treated all pens May 13th-19th

Rant: Treating all pens May 24th-30th

Millar and Ross: Just spoke [REDACTED] and he is planning a treatment at these sites; he said they will start this weekend or early next week.

Biosecurity order for all Tofino sites:

Tofino Sites

Bawden

Rant

Mussel

Saranac

Ross

Millar

s.16(2)(c)

s.19(1)

Dixon
Fortune
Binns
Westside

Thanks,



CERMAQ

Phone +1 250-286-0022

Direct +1 250-286-0022 Ext: [REDACTED]

Mobile [REDACTED]

Cermaq Canada Ltd.
203 - 919 Island Hwy
V9W 2C2 Campbell River, BC, Canada

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Paylor, Adrienne

From: Paylor, Adrienne
Sent: June-13-17 8:55 AM
To: Sandberg, Krista
Subject: RE: Reporting sea lice problem Area 12 Mainland

Ok great thanks Krista. I think Howie is going to try you on your cell to see if there is anything he can do to help.
Adrienne

From: Sandberg, Krista
Sent: Tuesday, June 13, 2017 8:46 AM
To: Paylor, Adrienne
Subject: Re: Reporting sea lice problem Area 12 Mainland

I should be back early afternoon on Wednesday and can put that together fairly quickly for you then. In the meantime you can check out the online public reports or the public reporting folder on the AQUA drive that will have the area abundance graphs.

Krista.

Sent from my BlackBerry 10 smartphone on the Rogers network.

From: Paylor, Adrienne
Sent: Monday, June 12, 2017 3:44 PM
To: Sandberg, Krista
Cc: Shaw, Kerra; Manchester, Howie; Keith, Ian
Subject: FW: Reporting sea lice problem Area 12 Mainland

Hi Krista just a heads up,
As per below we are going to have to pull some SL info together on Zone 3.3 for the last three years to brief the RDG. I know you are at the trade show tomorrow so I will work with what I can find on the Aqua\$ drive and touch base with you on Wed (if your around?) to see if you any further suggests on how best to summarize/show the info for management to respond [REDACTED]
Thanks,
Adrienne

From: Thomson, Andrew
Sent: Monday, June 12, 2017 12:22 PM
To: Calla, Karen
Cc: Paylor, Adrienne; Klaver, March; Lavigne, Lauren; Struthers, Alistair; LaRue, Jean-François
Subject: RE: Reporting sea lice problem Area 12 Mainland

Thanks for forwarding. We'll need an internal review of lice levels in Area 12 to provide info to RDG and above.

Andrew J L Thomson
Regional Director | Directeur Régionale
Fisheries Management Branch | Direction de la gestion des pêches
Pacific Region | Region du Pacifique
Fisheries & Oceans Canada | Pêches et Océans Canada
Suite 200 – 401 Burrard St.
Vancouver, BC, Canada V6C 3S4

s.19(1)

andrew.thomson@dfo-mpo.gc.ca

Telephone | Téléphone 604.666.0751

Facsimile | Télécopieur 250.666.8069

Government of Canada | Gouvernement du Canada

From: Calla, Karen

Sent: Monday, June 12, 2017 12:18 PM

To: Thomson, Andrew <Andrew.Thomson@dfo-mpo.gc.ca>; Paylor, Adrienne <Adrienne.Paylor@dfo-mpo.gc.ca>; Klaver, March <March.Klaver@dfo-mpo.gc.ca>; Lavigne, Lauren <Lauren.Lavigne@dfo-mpo.gc.ca>; Struthers, Alistair <Alistair.Struthers@dfo-mpo.gc.ca>; LaRue, Jean-François <Jean-Francois.LaRue@dfo-mpo.gc.ca>

Subject: Fw: Reporting sea lice problem Area 12 Mainland

Fyi

Karen Calla

Sent from my BlackBerry

From: [REDACTED]

Sent: Monday, June 12, 2017 11:35 AM

To: Calla, Karen; Taylor, Nathan; Reid, Rebecca

Cc: Minister / Ministre (DFO/MPO)

Subject: Reporting sea lice problem Area 12 Mainland

Dear Karen Calla, Nathan Taylor and Rebecca Reid - *Fisheries and Oceans Canada*.

I am writing to inform Fisheries and Oceans Canada that you have a serious sea louse outbreak, for the third year in a row, on the Area 12 Mainland juvenile pink and chum salmon. This is Musgamagw Dzawada'enuxw Territory also called the Broughton Archipelago. Furthermore, the abundance of juvenile out-migrating salmon is the lowest observed [REDACTED]

[REDACTED] Over 85% of the juvenile salmon exiting the archipelago are infected with sea lice, many are over the lethal limit established by science published by DFO, [REDACTED] and others. The nature of the infection pinpoints the farms as the source i.e., high abundance of the most juvenile stage sea lice at the farms.

After enormous effort by First Nations, government and non-government scientists and organizations, we did establish a farm salmon sea louse treatment protocol that reduced lice on farm salmon in the region prior to the juvenile salmon outmigration. This appeared to be highly successful in reducing sea lice on juvenile salmon and boosting wild salmon survival.

However, this trend began reversing direction in 2015. In a paper [REDACTED] on the 2015 sea louse infection, we report 9% - 39% mortality due to sea lice, on top of natural mortality. We propose that the 2015 outbreak was caused by a combination of poorly-timed sea louse treatment of the farm salmon and a warm winter. Our sea louse counts were in agreement with the salmon farming industry's observations (Mainstream Biological Consulting).

Last winter was exceptionally cold which leaves us with only "poorly timed treatments" of farm salmon as the leading cause of the 2017 outbreak, which is more severe than in 2015.

I offer the suggestion that perhaps the industry is faced with significant loss in production/profits when they treat PRV-infected farm salmon for sea lice as per DFO research reporting that sea louse treatment triggered onset of HSMI in PRV infected fish (DiCicco et al 2017). We know as

s.19(1)

per Dr. Marty's statement on the Marine Harvest website that 80% of farm salmon are infected with PRV and that most farm salmon hatcheries are infected with PRV, which DFO permits to be transferred into marine pens.

Therefore the question is: is the industry is faced with causing substantive loss to shareholders if they treat for sea lice to protect wild salmon, i.e. the health of farm salmon does not require treatment, and that this treatment can result in disruption in the weight-gain essential to salmon farming profits. I can see this being a conflict of the corporate mandate.

The other possibility is sea louse drug-resistance, a global issue costing the industry billions of dollars which the industry has failed to resolve.

It is important to note that the sea lice levels we are documenting this year are comparable to levels that triggered the enormous effort in the early 2000's to control lice on the farms. My intention in writing to you is to formally inform you that the problem of sea lice from salmon farms threatening wild salmon populations has returned and will require the same level of action which DFO deemed necessary the last time this problem arose. This is no small problem as the Norwegian-run salmon farming in BC is well aware of in other parts of the world.

In my view, the loss of so many wild salmon to sea lice from salmon farms in the territory of First Nations who have rejected the industry for the past 30 years, and have served the industry eviction notices, puts the credibility of the Prime Minister's commitment to First Nations at risk.

As well, if Minister LeBlanc ignores this outbreak, his reputation as a minister whose committed to scientific evidence-based conservation exceeds that of the previous government is also put at risk.

Please let me know how I can assist you. This is a global problem, with no solution in evidence and so will require significant commitment from Canada if wild salmon are going to survive.

Thank you,



s.19(1)

Paylor, Adrienne

From: Paylor, Adrienne
Sent: June-13-17 1:21 PM
To: Calla, Karen
Subject: [REDACTED]

Just left you a long winded message ☺ I'm in the CR office when your ready for a call. thx

From: Calla, Karen
Sent: Tuesday, June 13, 2017 1:01 PM
To: Paylor, Adrienne
Subject: [REDACTED]

Could you please call me [REDACTED] Thanks, Karen

From: LaRue, Jean-François
Sent: Tuesday, June 13, 2017 10:08 AM
To: Calla, Karen <Karen.Calla@dfo-mpo.gc.ca>
Cc: Campbell, John P. <John.Campbell@dfo-mpo.gc.ca>; Struthers, Alistair <Alistair.Struthers@dfo-mpo.gc.ca>
Subject: [REDACTED]

Karen

[REDACTED]

Merci
JF

From: LaRue, Jean-François
Sent: Tuesday, June 13, 2017 1:02 PM
To: Campbell, John P. <John.Campbell@dfo-mpo.gc.ca>; Struthers, Alistair <Alistair.Struthers@dfo-mpo.gc.ca>
Cc: Lavigne, Joliane <Joliane.Lavigne@dfo-mpo.gc.ca>; Jones, Robert <Robert.Jones@dfo-mpo.gc.ca>; Hamel, Anne-Marie <Anne-Marie.Hamel@dfo-mpo.gc.ca>; Baldwin, Jennifer <Jennifer.Baldwin@dfo-mpo.gc.ca>
Subject: [REDACTED]

Salut

[REDACTED]

JF

From: Morel, Philippe
Sent: Tuesday, June 13, 2017 12:58 PM
To: LaRue, Jean-François <Jean-Francois.LaRue@dfo-mpo.gc.ca>

s.21(1)(a)

s.21(1)(b)

s.23

Cc: Richter, Julie <Julie.Richter@dfo-mpo.gc.ca>

Subject: [REDACTED]

Jean-Francois

Philippe

Philippe Morel

ADM, Ecosystems and Fisheries Management

Fisheries and Oceans Canada

SMA, Gestion des Écosystèmes et des pêches

Pêches et Océans Canada

Tel: 613-993-1914

De: Sharzer, Stephen <Stephen.Sharzer@dfo-mpo.gc.ca>

Envoyé: mardi 13 juin 2017 12:52

À: Morel, Philippe

Cc: Richter, Julie; LaRue, Jean-François; Cossette, Patrick; Ikejiani, Alexander; Birba, Rose-Gabrielle

Objet: [REDACTED]

Protected Solicitor-Client and Litigation Privilege

Philippe

Steve

s.21(1)(a)

s.21(1)(b)

s.23

**Pages 181 to / à 183
are withheld pursuant to section
sont retenues en vertu de l'article**

23

**of the Access to Information Act
de la Loi sur l'accès à l'information**

Manchester, Howie

From: Sandberg, Krista
Sent: June-13-17 1:29 PM
To: Charbonneau, Michelle
Cc: Manchester, Howie
Subject: Re: Notification of Slice Treatments

Did you look at all 3 tabs for the AAR notification spreadsheet? I know they are all there. I've QA/QC'd everything to end of 2016

Sent from my BlackBerry 10 smartphone on the Rogers network.

From: Charbonneau, Michelle
Sent: Tuesday, June 13, 2017 1:21 PM
To: Sandberg, Krista
Cc: Manchester, Howie
Subject: RE: Notification of Slice Treatments

Hey Krista,

A question : We're mining data to get slice and H2O2 treatments for zones 3.3 and 3.4.

If I look at the AAR Notification spreadsheet (from your path below), I get one return.

2015	3.3	Marine Harvest		Althorpe	1300	Emamectin B
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If I look at this spreadsheet ([X:\AEO\Courtenay\FH\Antibiotic Slice\ Antibiotic and Production Summary ALL COMPANIES.xls](#)), I get way more:

s.19(1)

A	B	C	D	E
Company	Facility Reference No	Facility Name	Landfile No	Fish Health Zone
Marine Harvest Canada	1293	Duncan Island, Goletas Channel	1407326	3-4
Marine Harvest Canada	141	Port Elizabeth, Gilford Island	1403104	3-3
Marine Harvest Canada	465	Swanson Island, North side	1404381	3-3
Marine Harvest Canada	467	Midsummer Island, Spring Passage	1404380	3-3
Cermaq	728	Sir Edmund Bay, NE Shore Broughton Inlet	1404179	3-3
Cermaq	819	Cecil Island, Greenway Sound	1405181	3-3
Marine Harvest Canada	820	Wicklow Point, Broughton Island	1405183	3-3
Marine Harvest Canada	821	Glacial Falls, Watson Cove, Tribune Channel	1405180	3-3
Cermaq	1144	Burdwood Group, Raleigh Passage	1406650	3-3
Marine Harvest Canada	1145	Potts Bay, Midsummer Island	1406655	3-3
Marine Harvest Canada	1288	Doyle Island, Gordon Group	1407325	3-4
Marine Harvest Canada	1288	Doyle Island, Gordon Group	1407325	3-4
Marine Harvest Canada	1300	Althorpe, Sunderland Channel	1407426	3-3
Marine Harvest Canada	1300	Althorpe, Sunderland Channel	1407426	3-3
Marine Harvest Canada	1351	Marsh Bay, Stuart Rock N. of P. Hardy	1407749	3-4
Marine Harvest Canada	1586	Doctor Islets, Knight Inlet	1408758	3-3

Can you please explain the difference? What am I missing? I just summarized lice treatments using the AAR sheet for Howie and it's not comprehensive. I don't want to make that mistake again.

Can you please also confirm that I can take the Antibiotic and Production Summary ALL COMPANIES.xls spreadsheet as complete and summarize all of 2014-2017 (submitted to date) for 3.3 and 3.4 Slice and H2O2 use?

Thanks so much!

Michelle Charbonneau

Michelle.Charbonneau@dfo-mpo.gc.ca

Telephone | Téléphone 250-895-1724

From: Sandberg, Krista
Sent: Thursday, May 25, 2017 12:14 PM
To: Charbonneau, Michelle
Cc: Manchester, Howie
Subject: RE: Notification of Slice Treatments

Hey Michelle, you are absolutely right, I do have a spreadsheet for that! Here's the link:

X:\AEO\Courtenay\FH\Antibiotic Slice\AAR Notification Tracking.xls

This is for all notifications that come in to the AAR inbox. I also cross check it with mortality by category reports to ensure that all deposits have appropriate notifications and vice versa.

Cheers,
Krista.

Krista Sandberg

telephone: 250 286 5835

telephone: 250 286 5835

cellular: [REDACTED]

telephone portable: [REDACTED]

From: Charbonneau, Michelle
Sent: Thursday, May 25, 2017 12:03 PM
To: Sandberg, Krista
Cc: Manchester, Howie
Subject: Notification of Slice Treatments

Hey Krista,

Could you please help clear something up?

Where would I go to see the most recent notifications of pending/upcoming/planned Slice treatments?

Sometimes notification comes into the XPAC AQFF FishHealth Inbox, but not consistently. And they aren't fish health events so this isn't the place to look. I can see in the MbyC stuff that Vet Diagnosis column captures SLICE but they are not submitted until the 15th of the next month. This notification comes in consistently within 72hrs of a planned treatment for AAR requirements, does it not? How is that compiled/stored? In an amazing spreadsheet no doubt 😊

Please tell me if this is possible:

I would like to check on notifications of recently completed or proposed and upcoming SLICE treatments before we attend a sea lice audit. Industry is supposed to inform us well in advance when a SLICE treatment is scheduled within a month of our audit. Unfortunately, the notice sometimes doesn't arrive in a timely manner. I'm wondering if you have a tool that can help us out?

Thanks!

MC

Manchester, Howie

From: Charbonneau, Michelle
Sent: June-13-17 1:30 PM
To: Manchester, Howie
Subject: RE: Slice or H2O2 treatments in 3.3 and 3.4 for 2015-2017
Attachments: Slice H2O2 Zones 3.3 & 3.4 2015-17.xls

Hey,

AS we discussed, I found inconsistent info between the two spreadsheets. Here is what the Antibiotic and Production Summary_ALL COMPANIES, had. It is also now the first tab of the spreadsheet (updated and attached). Note that tab has all companies and from 2013-2016 but you can sort for the years and zones you want.

This is sorted for 2014-2016, zones 3.3 and 3.4:

Company	Facility Reference No	Facility Name	Landfile No	Fish Health Zone	Calendar Month	Species
Grieg Seafood	1825	Bennett Point, Clio Channel	1411154	3-3	DEC	Atlantic Salmon
Marine Harvest						Atlantic Salmon
Canada	467	Midsummer Island, Spring Passage	1404380	3-3	FEB	Atlantic Salmon
Grieg Seafood	1825	Bennett Point, Clio Channel	1411154	3-3	FEB	Atlantic Salmon
Marine Harvest		Glacial Falls, Watson Cove, Tribune				Atlantic Salmon
Canada	821	Channel	1405180	3-3	JAN	Atlantic Salmon
Marine Harvest						Atlantic Salmon
Canada	1059	Sargeaunt Passage, Tribune Channel	1403328	3-3	JAN	Atlantic Salmon
Marine Harvest						Atlantic Salmon
Canada	1145	Potts Bay, Midsummer Island	1406655	3-3	JAN	Atlantic Salmon
Marine Harvest						Atlantic Salmon
Canada	1618	Humphrey Rock, Tribune Channel	1409707	3-3	JAN	Atlantic Salmon
Marine Harvest						Atlantic Salmon
Canada	1145	Potts Bay, Midsummer Island	1406655	3-3	NOV	Atlantic Salmon
Marine Harvest						Atlantic Salmon
Canada	820	Wicklow Point, Broughton Island	1405183	3-3	NOV	Atlantic Salmon
Marine Harvest						Atlantic Salmon
Canada	1288	Doyle Island, Gordon Group	1407325	3-4	DEC	Atlantic Salmon
Marine Harvest						Atlantic Salmon
Canada	1293	Duncan Island, Goletas Channel	1407326	3-4	DEC	Atlantic Salmon
Marine Harvest						Atlantic Salmon
Canada	892	Goletas Channel, S.E. Bell Island	1404918	3-4	NOV	Atlantic Salmon
Marine Harvest						Atlantic Salmon
Canada	831	Shelter Passage, Wishart Island	1404091	3-4	OCT	Atlantic Salmon
Marine Harvest						Atlantic Salmon
Canada	1351	Marsh Bay, Stuart Rock N. of P. Hardy	1407749	3-4	SEP	Atlantic Salmon

Cermaq	819	Cecil Island, Greenway Sound	1405181	3-3	APR	Atlantic Salmon
Marine Harvest						Atlantic Salmon
Canada	1145	Potts Bay, Midsummer Island	1406655	3-3	APR	Atlantic Salmon
Marine Harvest						Atlantic Salmon
Canada	1300	Althorpe, Sunderland Channel	1407426	3-3	APR	Atlantic Salmon
Marine Harvest						Atlantic Salmon
Canada	1300	Althorpe, Sunderland Channel	1407426	3-3	DEC	Atlantic Salmon
Marine Harvest						Atlantic Salmon
Canada	465	Swanson Island, North side	1404381	3-3	FEB	Atlantic Salmon
Marine Harvest						Atlantic Salmon
Canada	467	Midsummer Island, Spring Passage	1404380	3-3	FEB	Atlantic Salmon
Marine Harvest						Atlantic Salmon
Canada	1586	Doctor Islets, Knight Inlet	1408758	3-3	FEB	Atlantic Salmon
Marine Harvest						Atlantic Salmon
Canada	820	Wicklow Point, Broughton Island	1405183	3-3	JUL	Atlantic Salmon
Marine Harvest		Glacial Falls, Watson Cove, Tribune				Atlantic Salmon
Canada	821	Channel	1405180	3-3	JUN	Atlantic Salmon
Cermaq	728	Sir Edmund Bay, NE Shore Broughton Inlet	1404179	3-3	MAR	Atlantic Salmon
Marine Harvest						Atlantic Salmon
Canada	141	Port Elizabeth, Gilford Island	1403104	3-3	MAY	Atlantic Salmon
Cermaq	1144	Burdwood Group, Raleigh Passage	1406650	3-3	MAY	Atlantic Salmon
Marine Harvest						Atlantic Salmon
Canada	1288	Doyle Island, Gordon Group	1407325	3-4	JUL	Atlantic Salmon
Marine Harvest						Atlantic Salmon
Canada	1293	Duncan Island, Goletas Channel	1407326	3-4	JUL	Atlantic Salmon
Marine Harvest						Atlantic Salmon
Canada	1288	Doyle Island, Gordon Group	1407325	3-4	JUN	Atlantic Salmon
Marine Harvest						Atlantic Salmon
Canada	1351	Marsh Bay, Stuart Rock N. of P. Hardy	1407749	3-4	NOV	Atlantic Salmon
Marine Harvest						Atlantic Salmon
Canada	141	Port Elizabeth, Gilford Island	1403104	3-3	FEB	Atlantic Salmon
Marine Harvest						Atlantic Salmon
Canada	467	Midsummer Island, Spring Passage	1404380	3-3	FEB	Atlantic Salmon
Marine Harvest		Glacial Falls, Watson Cove, Tribune				Atlantic Salmon
Canada	821	Channel	1405180	3-3	FEB	Atlantic Salmon
Marine Harvest						Atlantic Salmon
Canada	1059	Sargeaunt Passage, Tribune Channel	1403328	3-3	FEB	Atlantic Salmon
Marine Harvest						Atlantic Salmon
Canada	1145	Potts Bay, Midsummer Island	1406655	3-3	FEB	Atlantic Salmon
Marine Harvest						Atlantic Salmon
Canada	1618	Humphrey Rock, Tribune Channel	1409707	3-3	FEB	Atlantic Salmon
Marine Harvest						Atlantic Salmon
Canada	1145	Potts Bay, Midsummer Island	1406655	3-3	JAN	Atlantic Salmon
Marine Harvest		Glacial Falls, Watson Cove, Tribune				Atlantic Salmon
Canada	821	Channel	1405180	3-3	JUN	Atlantic Salmon
Marine Harvest						Atlantic Salmon
Canada	1059	Sargeaunt Passage, Tribune Channel	1403328	3-3	MAR	Atlantic Salmon
Marine Harvest						Atlantic Salmon
Canada	1618	Humphrey Rock, Tribune Channel	1409707	3-3	MAR	Atlantic Salmon

Marine Harvest Canada	1586	Doctor Islets, Knight Inlet	1408758	3-3	MAY	Atlantic Salmon
Marine Harvest Canada	1581	Hardwicke Is. Site B, Chancellor Channel	1409321	3-3	NOV	Atlantic Salmon
Marine Harvest Canada	831	Shelter Passage, Wishart Island	1404091	3-4	DEC	Atlantic Salmon
Marine Harvest Canada	1288	Doyle Island, Gordon Group	1407325	3-4	DEC	Atlantic Salmon
Marine Harvest Canada	7053	Ghi ya, Bull Harbour, Hope Isl	1414224	3-4	JUL	Atlantic Salmon
Marine Harvest Canada	1350	Shelter Bay, Richards Channel	1407748	3-4	MAR	Atlantic Salmon
Marine Harvest Canada	7053	Ghi ya, Bull Harbour, Hope Isl	1414224	3-4	MAR	Atlantic Salmon
Marine Harvest Canada	1351	Marsh Bay, Stuart Rock N. of P. Hardy	1407749	3-4	MAY	Atlantic Salmon
Marine Harvest Canada	1288	Doyle Island, Gordon Group	1407325	3-4	NOV	Atlantic Salmon
Marine Harvest Canada	1293	Duncan Island, Goletas Channel	1407326	3-4	OCT	Atlantic Salmon
Marine Harvest Canada	1293	Duncan Island, Goletas Channel	1407326	3-4	SEP	Atlantic Salmon

Michelle Charbonneau

Michelle.Charbonneau@dfo-mpo.gc.ca

Telephone | Téléphone 250-895-1724

From: Charbonneau, Michelle
Sent: Tuesday, June 13, 2017 12:11 PM
To: Manchester, Howie
Subject: RE: Slice or H2O2 treatments in 3.3 and 3.4 for 2015-2017

The spreadsheet I forgot to attach.

Michelle Charbonneau

Michelle.Charbonneau@dfo-mpo.gc.ca

Telephone | Téléphone 250-895-1724

From: Charbonneau, Michelle
Sent: Tuesday, June 13, 2017 12:10 PM
To: Manchester, Howie
Subject: Slice or H2O2 treatments in 3.3 and 3.4 for 2015-2017

Hey Howie,

Here are slice or H2O2 treatments in 3.3 and 3.4 for 2015-2017. The spreadsheet is attached; the first tab is a summary of 2015-2017 and the raw data from Krista's AAR spreadsheet is in the three following tabs. Note that brood sites are included.

Year	Zone	Company	Submitted By	Facility Name	Facility Reference Number	Name of Person
2015	3.3	Marine Harvest		Althorpe	1300	Emamectin B
2016	3.3	Marine Harvest		Port Elizabeth	141	Emamectin B
2016	3.3	Marine Harvest		Midsummer	467	Emamectin B
2016	3.3	Marine Harvest		Glacier Falls	821	Emamectin B
2016	3.3	Marine Harvest		Glacier Falls	821	Emamectin B
2016	3.4	Marine Harvest		Shelter Passage, Wishart Island	831	Hydrogen Pe
2016	3.3	Marine Harvest		Sargeaunt Pass	1059	Emamectin B
2016	3.3	Marine Harvest		Potts Bay	1145	Emamectin B
2016	3.4	Marine Harvest		Doyle Island, Gordon Group	1288	Hydrogen Pe
2016	3.4	Marine Harvest		Duncan Island, Goletas Channel	1293	Hydrogen Pe
2016	3.4	Marine Harvest		Shelter Bay	1350	Emamectin B
2016	3.4	Marine Harvest		Marsh Bay	1351	Emamectin B
2016	3.3	Marine Harvest		Doctor Islets	1586	Emamectin B
2016	3.3	Marine Harvest		Humphrey Rock	1618	Emamectin B
2016	3.4	Marine Harvest		Bull Harbour	7053	Emamectin B
2016	3.4	Marine Harvest		Ghi ya, Bull Harbour, Hope Isl	7053	Hydrogen Pe
2017	3.3	Cermaq		Sir Edmund Bay	728	Emamectin B
2017	3.3	Cermaq		Burdwood	1144	Emamectin B
2017	3.3	Cermaq		Cypress Harbour	458	Emamectin B
2017	3.3	Cermaq		Maude	869	Emamectin B
2017	3.3	Marine Harvest		Althorpe	1300	Emamectin B
2017	3.3	Marine Harvest		Swanson	465	Emamectin B
2017	3.3	Marine Harvest		Potts Bay	1145	Emamectin B
2017	3.3	Marine Harvest		Midsummer	467	Emamectin B
2017	3.3	Grieg		Noo-la	1825	Emamectin B
2017	3.3	Grieg		Wa-kwa	1839	Emamectin B
2017	3.4	Marine Harvest		Duncan	1293	Emamectin B
2017	3.4	Marine Harvest		Shelter Pass	831	Emamectin B
2017	3.4	Marine Harvest		Doyle	1288	Emamectin B

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Company	Submitted By	Facility Name	Facility Reference Number	Facility Coordinates	Name of Pesticide	Date of Notification	Predicted Start of Deposit	Actual Deposit Date	# days before deposit	Entered in AQUIS?	Month Reported in Mortality by Category	Comments
Marine Harvest		Phillips Arm	78		Enamectin Benzoate	15-Jan-17		05-Dec-16	-41	- All Zones	December	Reported in Mortality by Category, but no deposit notification received
Marine Harvest		Lees Bay	100	50 24 496N 125 42.039W	Enamectin Benzoate	01-Jun-16	04-Jun-16	?	3	yes	June	
Marine Harvest		Lees Bay	100	50 24 496N 12 42. 039 W	Enamectin Benzoate	16-Nov-16	20-Nov-16	20-Nov-16	4	yes	November	
Marine Harvest		Lees Bay, N. Shore, West Thurlow Is.	100		Hydrogen Peroxide	15-Jun-16		10-May-16	-36	yes	MAY	Deposit notifications not received. Licence holder was not aware that H2O2 required notification. Will send for all future deposits
Marine Harvest		Port Elizabeth	141	50 40 234N 126 28 654W	Enamectin Benzoate	15-Feb-16	19-Feb-16	19-Feb-16	4	yes	February	
Marine Harvest		Okisollo	211	50 18 573N 125 19 144W	Enamectin Benzoate	21-Apr-16	24-Apr-16	23-Apr-16	4	yes	April	
Marine Harvest		Sonora Island, Okisollo Channel	211		Hydrogen Peroxide	15-Oct-16		?	#VALUE!	yes	SEP	Deposit notifications not received. Licence holder was not aware that H2O2 required notification. Will send for all future deposits
Cermaq		Bawden	227	49° 18.366'N 126° 00.547'W	Enamectin Benzoate	18-Feb-16	16-Feb-16	16-Feb-16	-2	yes	February	Missed reporting mortality and antibiotic use for this facility, email sent 6-June requesting amended report; received corrected report 7-June
Marine Harvest		Glacial Creek	303	50 00.585N 123 54.189W	Enamectin Benzoate	12-Feb-16	17-Feb-16	17-Feb-16	5	yes	February	
Cermaq		Venture	306	50 18.140'N 125 20.273'W	Enamectin Benzoate	28-Mar-16	26-Mar-16	26-Mar-16	-2	yes	March/April	
Cermaq		Ross Pass	314	49° 18.366'N 126° 00.547'W	Enamectin Benzoate	18-Feb-16	21-Feb-16	21-Feb-16	3	yes	February	
Marine Harvest		Sonora Point	380	50 25.256N 125 18.271W	Enamectin Benzoate	21-Dec-16	24-Dec-16	24-Dec-16	3	yes	December	
Marine Harvest		Sonora Pt., Nodales Channel	380		Hydrogen Peroxide	15-Sep-16		05-Aug-16	-41	yes	AUG	Deposit notifications not received. Licence holder was not aware that H2O2 required notification. Will send for all future deposits
Marine Harvest		Midsummer	467	50 39.327N 126 39.972W	Enamectin Benzoate	15-Feb-16	14-Feb-16	14-Feb-16	-1	yes	February	
Cermaq		Saranac	527	49 14.723 N 125 54.260'W	Enamectin Benzoate	24-Jun-16	21-Jul-16	?	27	yes	July	Start around 2nd week of July, pending date email update received 20-Jul with planned start date 21-Jul
Marine Harvest		Chancellor	790	50 24.810N 125 39.528 W	Enamectin Benzoate	16-Nov-16	20-Nov-16	21-Nov-16	5	yes	November	
Marine Harvest		Glacier Falls	821	50 50.860N 126 19.262W	Enamectin Benzoate	15-Feb-16	18-Feb-16	18-Feb-16	3	yes	February	
Marine Harvest		Glacier Falls	821	50 50. 860N 126 19. 262 W	Enamectin Benzoate	10-Jun-16	13-Jun-16	?	3	yes	June	
Marine Harvest		Shelter Passage, Wishart Island	831		Hydrogen Peroxide	15-Dec-16		28-Nov-16	-17	yes	DEC	Deposit notifications not received. Licence holder was not aware that H2O2 required notification. Will send for all future deposits
Grieg		Barnes Bay	871	50°19.4598' Lat 125°15.6335' 50 40.248N 126 11.148W	Enamectin Benzoate	07-Apr-16	05-May-16	?	28	yes	May	
Marine Harvest		Sargeant Pass	1059		Enamectin Benzoate	25-Feb-16	28-Feb-16	29-Feb-16	4	yes	February/March	Original email was lost, resent 4-Oct. In compliance
Grieg		Steamer	1079	49°53.2563' 126°47.4527'	Enamectin Benzoate	12-Sep-16	14-Sep-16	?	2	yes	September	original notification was 8-Aug-16 but SLICE not administered due to environmental conditions
Marine Harvest		Potts Bay	1145	50 38.941N 126 37.101W	Enamectin Benzoate	19-Jan-16	22-Jan-16	23-Jan-16	4	yes	January/February	
Cermaq		Binnis	1148	49° 20.377'N 125° 57.198'W	Enamectin Benzoate	18-Feb-16	28-Feb-16	?	10	yes	March	
Marine Harvest		Doyle Island, Gordon Group	1288		Hydrogen Peroxide	15-Jan-17		?	#VALUE!	yes	November/December	Deposit notifications not received. Licence holder was not aware that H2O2 required notification. Will send for all future deposits
Marine Harvest		Duncan Island, Goletas Channel	1293		Hydrogen Peroxide	15-Oct-16		27-Sep-16	-18	yes	September/October	Deposit notifications not received. Licence holder was not aware that H2O2 required notification. Will send for all future deposits

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Company	Submitted By	Facility Name	Facility Reference Number	Facility Coordinates	Name of Pesticide	Date of Notification	Predicted Start of Deposit	Actual Deposit Date	# days before deposit	Entered in AQUIS?	Month Reported in Mortality by Category	Comments
Marine Harvest		Shelter Bay	1350	50°57.849N 127°27.298W	Enamectin Benzoate	25-Feb-16	29-Feb-16	03-Mar-16	7	yes	March	Original email was lost, present 4-Oct. In compliance
Marine Harvest		Marsh Bay	1351	50°54.330N 125°20.592W	Enamectin Benzoate	24-Apr-16	27-Apr-16	27-Apr-16	3	yes	May	
Cermaq		Brent	1401	50°17.193'N 125°20.897'W	Enamectin Benzoate	28-Mar-16	26-Mar-16	26-Mar-16	-2	yes	March/April	
Cermaq		Westside	1472	49°16.745'N 125°49.849'W	Enamectin Benzoate	06-May-16	14-May-16	14-May-16	8	yes	May	
Cermaq		Millar Channel	1507	49°22.490'N 126°05.567'W	Enamectin Benzoate	18-Apr-16	21-Apr-16	21-Apr-16	3	yes	April/May	Deposit notification failed to send due to typo, actually received 4-Oct after email request, but intent was to send on 18-Apr
Cermaq		Bare Bluff	1537	49°19.729'N 125°47.905'W	Enamectin Benzoate	28-Mar-16	27-Mar-16	27-Mar-16	-1	yes	March/April	
Marine Harvest		Jackson Passage S. of Finlayson Channel	1580		Hydrogen Peroxide	15-Jul-16		13-Jun-16	-32	yes	JUN	Deposit notifications not received. Licence holder was not aware that H2O2 required notification. Will send for all future deposits
Marine Harvest		Jackson Passage S. of Finlayson Channel	1580		Hydrogen Peroxide	15-Nov-16		23-Oct-16	-23	yes	OCT	Deposit notifications not received. Licence holder was not aware that H2O2 required notification. Will send for all future deposits
Marine Harvest		Doctor Islets	1586	50°39.080N 126°17.431W	Enamectin Benzoate	16-May-16	21-May-16	22-May-16	6	yes	May	
Marine Harvest		Humphrey Rock	1618	50°41.797N 126°15.568W	Enamectin Benzoate	25-Feb-16	29-Feb-16	28-Feb-16	3	yes	February/March	Original email was lost, present 4-Oct. In compliance
Marine Harvest		Kid Bay, Roderick Island	1691		Hydrogen Peroxide	15-Mar-16		28-Feb-16	-16	yes	FEB	Deposit notifications not received. Licence holder was not aware that H2O2 required notification. Will send for all future deposits
Marine Harvest		Kid Bay, Roderick Island	1691		Hydrogen Peroxide	15-Apr-16		28-Mar-16	-18	yes	MAR	Deposit notifications not received. Licence holder was not aware that H2O2 required notification. Will send for all future deposits
Grieg		Culloden	1697	49°47.7658' 124°5.9181'	Enamectin Benzoate	06-Jun-16	10-Jun-16	14-Jun-16	8	yes	June	email said treatment on May 10th but I think that was a typo
Grieg		Ahlstrom	1698	49°46.7116' 124°9.2602'	Enamectin Benzoate	06-Jun-16	10-Jun-16	14-Jun-16	8	yes	June	email said treatment on May 10th but I think that was a typo
Marine Harvest		Goat Cove	1702	50°47.156N 128°45.037W	Enamectin Benzoate	16-May-16	19-May-16	19-May-16	3	yes	May	
Marine Harvest		Goat Cove, Roderick Island	1702		Hydrogen Peroxide	15-Mar-16		25-Feb-16	-19	yes	February/March	Deposit notifications not received. Licence holder was not aware that H2O2 required notification. Will send for all future deposits
Grieg		Williamson	1705	49°39.3604' 126°25.7438'	Enamectin Benzoate	04-Apr-16	08-Apr-16	?	4	yes	April	original notification was 8-Aug-16 but SLICE not administered due to environmental conditions
Grieg		Esperanza	1863	49°52.6973' 126°45.6974'	Enamectin Benzoate	12-Sep-16	14-Sep-16	13-Sep-16	1	yes	September	Reported in Mortality by Category, but no deposit notification received
Marine Harvest		Sheep Passage	1895		Enamectin Benzoate	15-Jul-16		22-Jun-16	-23	YES	June	Deposit notifications not received. Licence holder was not aware that H2O2 required notification. Will send for all future deposits
Marine Harvest		Sheep Passage in vicinity of Pooley Isl.	1895		Hydrogen Peroxide	15-May-16		25-Apr-16	-20	yes	April/May	Deposit notifications not received. Licence holder was not aware that H2O2 required notification. Will send for all future deposits
Marine Harvest		Sheep Passage in vicinity of Pooley Isl.	1895		Hydrogen Peroxide	15-Nov-16		30-Oct-16	-16	yes	NOV	Deposit notifications not received. Licence holder was not aware that H2O2 required notification. Will send for all future deposits
Marine Harvest		Sheep Passage in vicinity of Pooley Isl.	1895		Hydrogen Peroxide	15-Nov-16		30-Oct-16	-16	yes	NOV	Deposit notifications not received. Licence holder was not aware that H2O2 required notification. Will send for all future deposits

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Company	Submitted By	Facility Name	Facility Reference Number	Facility Coordinates	Name of Pesticide	Date of Notification	Predicted Start of Deposit	Actual Deposit Date	# days before deposit	Entered in AQUIS?	Month Reported in Mortality by Category	Comments
Marine Harvest		Sheep Passage in vicinity of Pooley Isl.	1895		Hydrogen Peroxide	15-Jan-17		06-Dec-16	-40	yes	DEC	Deposit notifications not received. Licence holder was not aware that H2O2 required notification. Will send for all future deposits
Cermaq		Plover	6668	49° 12.848'N 125° 46.030'W	Enamectin Benzoate	18-Feb-16	17-Feb-16	17-Feb-16	-1	yes	February	
Marine Harvest		Bull Harbour	7053	50° 53.994'N 127° 56.393'W	Enamectin Benzoate	07-Jul-16	11-Jul-16	16-Jul-16	9	yes	July	
Marine Harvest		Ghi ya. Bull Harbour, Hope Isl	7053		Hydrogen Peroxide	15-Apr-16		21-Mar-16	-25	yes	MAR	Deposit notifications not received. Licence holder was not aware that H2O2 required notification. Will send for all future deposits
Marine Harvest		Hardwicke	1581		Enamectin Benzoate	15-Dec-16		21-Nov-16	-24	yes	November	Reported in Mortality by Category, but no deposit notification received

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Company	Submitted By	Facility Name	Facility Reference Number	Name of Pesticide	Date of Notification	Predicted Start of Deposit	Length of Treatment (days)	# days before deposit	Entered in AQUIS?	Month Reported in Mortality by Category	Comments
Cermaq		Raza	304	Emanectin Benzoate	10-Jan-17	15-Jan-17		5	Yes		
Cermaq		Sir Edmund Bay	728	Emanectin Benzoate	10-Jan-17	15-Jan-17		5	Yes		
Cermaq		Burdwood	1144	Emanectin Benzoate	10-Jan-17	15-Jan-17		5	Yes		
Cermaq		Cypress Harbour	458	Emanectin Benzoate	10-Jan-17	01-Feb-17		22	Yes		
Cermaq		Maude	869	Emanectin Benzoate	10-Jan-17	01-Feb-17		22	Yes		
Marine Harvest		Althorpe	1300	Emanectin Benzoate	15-Jan-17	18-Jan-17	10	3	Yes		
Marine Harvest		Swanson	465	Emanectin Benzoate	15-Jan-17	17-Jan-17	10	2	Yes		
Marine Harvest		Sheep Pass	1895	Hydrogen Peroxide	23-Jan-17	26-Jan-17	35	3	Yes		
Marine Harvest		Potts Bay	1145	Emanectin Benzoate	23-Jan-17	29-Jan-17	10	6	Yes		
Marine Harvest		Midsummer	467	Emanectin Benzoate	23-Jan-17	27-Jan-17	10	4	Yes		
Marine Harvest		Glacial Creek	303	Emanectin Benzoate	30-Jan-17	02-Feb-17	10	3	Yes		
Grieg		Noo-la	1825	Emanectin Benzoate	26-Jan-17	31-Jan-17		5	Yes		
Grieg		Wa-ka	1839	Emanectin Benzoate	26-Jan-17	31-Jan-17		5	Yes		
Marine Harvest		Duncan	1293	Emanectin Benzoate	21-Feb-17	23-Feb-17	10	2	Yes		
Marine Harvest		Shelter Pass	831	Emanectin Benzoate	28-Feb-17	02-Mar-17	10	2	Yes		
Marine Harvest		Doyle	1288	Emanectin Benzoate	28-Feb-17	02-Mar-17	10	2	Yes		
Grieg		Esperanza	1863	Paramove (Hydrogen Peroxide)	07-Apr-17	11-Apr-17		4	Yes		
Grieg		Steamer	1079	Paramove (Hydrogen Peroxide)	07-Apr-17	04-Apr-17		3	Yes		
Cermaq		Binns	1148	Emanectin Benzoate	04-Apr-17	07-Apr-17		9	Yes		
Grieg		Salten	332	Emanectin Benzoate	31-Mar-17	09-Apr-17		9	Yes		
Grieg		Site 13	746	Emanectin Benzoate	31-Mar-17	09-Apr-17		9	Yes		
Marine Harvest		Mahatta East	1338	Paramove 50 (hydrogen peroxide H2O2)	13-Apr-17	18-Apr-17	15	5	Yes		
Marine Harvest		Koskimo	144	Paramove 50 (hydrogen peroxide H2O2)	13-Apr-17	18-Apr-17	15	5	Yes		
Marine Harvest		Monday Rocks	1237	Paramove 50 (hydrogen peroxide H2O2)	13-Apr-17	18-Apr-17	15	5	Yes		
Cermaq		Mussel Rock	543	Emanectin Benzoate	18-May-17	19-May-17		1	No		
Cermaq		Rant	526	Emanectin Benzoate	18-May-17	22-May-17		4	No		
Cermaq		Ross	314	Emanectin Benzoate	18-May-17	02-Jun-17		15	No		
Cermaq		Millar	1507	Emanectin Benzoate	18-May-17	02-Jun-17		15	No		

notification of actual start date received 30-May to start [redacted] in next 2 weeks

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Company	Submitted By	Facility Name	Facility Reference Number	Facility Coordinates	Name of Pesticide	Date of Notification	Start of Deposit	# days before deposit	Entered in AQUIS?	Month Reported in Mortality by Category	Comments
Marine Harvest		Koskimo Bay, Quatsino Sound	144		Hydrogen Peroxide	15-Apr-15	03-Mar-15	-49	yes	MAR	Deposit notifications not received. Licence holder was not aware that H2O2 required notification.
Marine Harvest		Monday Rocks, Quatsino Sound	1237		Hydrogen Peroxide	15-Apr-15	?	#VALUE!	yes	MAR	Deposit notifications not received. Licence holder was not aware that H2O2 required notification.
Marine Harvest		Koskimo Bay, Quatsino Sound	144		Hydrogen Peroxide	15-Aug-15	08-Jul-15	-36	yes	JUL	Deposit notifications not received. Licence holder was not aware that H2O2 required notification.
Marine Harvest		Monday Rocks, Quatsino Sound	1237		Hydrogen Peroxide	15-Aug-15	12-Jul-15	-34	yes	JUL	Deposit notifications not received. Licence holder was not aware that H2O2 required notification.
Cermaq		Bedwell	520	49° 16.466'N 125° 48.031'W	Enamectin Benzoate	21-Sep-15	21-Jul-15	-62	yes	July	Late reporting, email [REDACTED] indicating that they were not aware of requirement until meeting with Ottawa. Notification sent as soon as were aware.
Cermaq		Brent Island	1401	50° 17.193' N 125° 20.897'W	Enamectin Benzoate	21-Sep-15	13-Sep-15	-8	yes	September	Late reporting, email [REDACTED] indicating that they were not aware of requirement until meeting with Ottawa. Notification sent as soon as were aware.
Cermaq		Mussel Rock	543	48° 15.562'N 125° 56.175'W	Enamectin Benzoate	21-Sep-15	21-Jul-15	-62	yes	July	Late reporting, email [REDACTED] indicating that they were not aware of requirement until meeting with Ottawa. Notification sent as soon as were aware.
Cermaq		Plover Point	6668	49° 12.846'N 125° 46.030'W	Enamectin Benzoate	21-Sep-15	14-Sep-15	-7	yes	September	Late reporting, email [REDACTED] indicating that they were not aware of requirement until meeting with Ottawa. Notification sent as soon as were aware.
Cermaq		Venture Point	306	50° 18.140' N 125° 20.273'W	Enamectin Benzoate	21-Sep-15	13-Sep-15	-8	yes	September	Late reporting, email [REDACTED] indicating that they were not aware of requirement until meeting with Ottawa. Notification sent as soon as were aware.
Grieg		Ahlstrom	1698	not provided	Enamectin Benzoate	02-Oct-15	06-Aug-15	-57	yes	August	Late reporting, new reporting requirement missed due to internal miscommunication; Should have been for Atrevida, not Ahlstrom.
Grieg		Concepcion	1789	not provided	Enamectin Benzoate	02-Oct-15	06-Aug-15	-57	yes	August	Late reporting, new reporting requirement missed due to internal miscommunication
Grieg		Salten	332	not provided	Enamectin Benzoate	02-Oct-15	04-Sep-15	-28	yes	September	Late reporting, new reporting requirement missed due to internal miscommunication
Grieg		Site 13	746	not provided	Enamectin Benzoate	02-Oct-15	03-Sep-15	-29	yes	September	Late reporting, new reporting requirement missed due to internal miscommunication
Grieg		Vantage	221	not provided	Enamectin Benzoate	02-Oct-15	03-Sep-15	-29	yes	September	Late reporting, new reporting requirement missed due to internal miscommunication
Grieg		Williamson	1705	not provided	Enamectin Benzoate	02-Oct-15	06-Aug-15	-57	yes	August	Late reporting, new reporting requirement missed due to internal miscommunication
Cermaq		Bawden	227	49° 18.366'N 126° 00.547'W	Enamectin Benzoate	06-Oct-15	24-Sep-15	-17	yes	September	Apologies for late notification while getting accustomed to new requirements
Cermaq		Dixon	234	48° 24.251'N 126° 09.100'W	Enamectin Benzoate	06-Oct-15	01-Oct-15	-5	yes	October	Apologies for late notification while getting accustomed to new requirements
Cermaq		Millar	1507	49° 22.490'N 126° 05.567'W	Enamectin Benzoate	06-Oct-15	15-Sep-15	-21	yes	September	Apologies for late notification while getting accustomed to new requirements
Cermaq		Ross Pass	314	49° 19.468'N 126° 02.920'W	Enamectin Benzoate	06-Oct-15	30-Sep-15	-6	yes	October	Apologies for late notification while getting accustomed to new requirements
Marine Harvest		Sonora Island	211	50.18.603N 125.18.849W	Enamectin Benzoate	06-Oct-15	09-Oct-15	3	yes	October	
Grieg		Ahlstrom	1698	49°46.7116' 124°9.2602'	Enamectin Benzoate	20-Oct-15	24-Oct-15	4	yes	October	
Grieg		Barnes Bay	871	50°19.4598' 125°15.6335'	Enamectin Benzoate	20-Oct-15	25-Oct-15	5	yes	October	
Marine Harvest		Goat Cove	1702	50.47.168 N 128.25.037 W	Enamectin Benzoate	01-Nov-15	03-Nov-15	2	yes	November	Notification received 1 day late
Marine Harvest		Kid Bay	1691	50.48.019 N 128.24.397 W	Enamectin Benzoate	01-Nov-15	03-Nov-15	2	yes	November	Notification received 1 day late
Marine Harvest		Kid Bay, Roderick Island	1691		Hydrogen Peroxide	15-Nov-15	29-Sep-15	-47	yes	OCT	Deposit notifications not received. Licence holder was not aware that H2O2 required notification.
Marine Harvest		Goat Cove, Roderick Island	1702		Hydrogen Peroxide	15-Nov-15	16-Oct-15	-30	yes	OCT	Deposit notifications not received. Licence holder was not aware that H2O2 required notification.
Marine Harvest		Hardwicke	1581	50.24.870N 125.46.178W	Enamectin Benzoate	16-Nov-15	19-Nov-15	3	yes	December	Deposition in November, reported in December
Marine Harvest		Sonora Point	380	50.25.542N 125.18.402W	Enamectin Benzoate	16-Nov-15	19-Nov-15	3	yes	December	Deposition in November, reported in December
Marine Harvest		Althorpe	1300	50.28.368N 125.48.514W	Enamectin Benzoate	30-Nov-15	04-Dec-15	4	yes	December	Deposition in November, reported in December

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Marine Harvest		Lochalsh Bay, Jackson Passage	884	Hydrogen Peroxide	15-Dec-15	20-Nov-15		yes	NOV	Deposit notifications not received. Licence holder was not aware that H2O2 required notification.
Greig		Culloden	1697	Enamectin Benzoate	12-Jan-16	24-Oct-15		yes	October	Originally missed notification, sent late.
Marine Harvest		Marsh Bay	1351	Enamectin Benzoate	15-Jan-16	n/a	#VALUE!	yes	November	Notification not received
Cermaq		Mussel Rock	543	Enamectin Benzoate	17-Feb-16	22-Dec-15		yes		Late, communication with Ian; not reported in December, will likely be January
Cermaq		Bedwell	520	Enamectin Benzoate	18-Feb-16	24-Dec-15		yes	December	Q1 2016 still not reported
Marine Harvest		Lime Bay, vicinity of Pooley Island	1896	Hydrogen Peroxide	15-May-15	18-Apr-15		yes	APR	Late, communication with Ian

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Year	Zone	Company	Submitted By	Facility Name	Facility Reference Number	Name of Pesticide	Date of Notification	Start of Deposit	# days before deposit
2015	3.3	Marine Harvest		Althorpe	1300	Emamectin Benzoate	30-Nov-15	04-Dec-15	4

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Company	Facility Reference No	Facility Name	Landfill No	Fish Health Zone	Calendar Month	Species	Notes	Brood/ Production	Year	Fish Health Category	Veterinary Diagnosis	Occurrence Category	Mitigative Action	Therapeutant Used (and Completed)	Other Therapeutants - Notes	Brand Name	Drug Identifier Number (GIN)	Dosage (Dose & Duration)	Weight of Active Therapeutant used (kg)	Anaesthetic Used During Month	Anaesthetics (g)
Marine Harvest Canada	78	Phillips Arm, Cardero Channel	2403170	3-2	JAN	Atlantic Salmon		Production	2013					Enamectin					0.761		
Marine Harvest Canada	78	Phillips Arm, Cardero Channel	2403170	3-2	JAN	Atlantic Salmon		Production	2015					Enamectin					0.761/231		
Marine Harvest Canada	1825	Bennett Point, Clio Channel	1411154	3-3	DEC	Atlantic Salmon		Production	2014					Enamectin					0.38948		
Marine Harvest Canada	467	Midsummer Island, Spring Passage	1404380	3-3	FEB	Atlantic Salmon		Production	2016					Enamectin					0.32708		
Marine Harvest Canada	1698	Ahlstrom Point, Jarvis Inlet	2408042	3-1	JUN	Atlantic Salmon		Production	2014					Enamectin					0.228		
Marine Harvest Canada	100	Lees Bay, N. Shore, West Thurlow Is.	1401949	3-2	MAR	Atlantic Salmon		Production	2015					Enamectin					0.80584		
Marine Harvest Canada	1825	Bennett Point, Clio Channel	1411154	3-3	FEB	Atlantic Salmon		Production	2014					Enamectin					0.039		
Marine Harvest Canada	144	Koskimo Bay, Quatsino Sound	1401723	2-4	MAR	Atlantic Salmon		Production	2013					Enamectin					0.05		
Marine Harvest Canada	144	Koskimo Bay, Quatsino Sound	1401722	2-4	NOV	Atlantic Salmon		Production	2013					Enamectin					0.23821611		
Marine Harvest Canada	144	Koskimo Bay, Quatsino Sound	1401722	2-4	FEB	Atlantic Salmon		Production	2014					Enamectin					0.90576		
Marine Harvest Canada	144	Koskimo Bay, Quatsino Sound	1401722	2-4	APR	Atlantic Salmon		Production	2015					Enamectin					0.2511		
Marine Harvest Canada	144	Koskimo Bay, Quatsino Sound	1401722	2-4	MAR	Atlantic Salmon		Production	2015					Hydrogen Peroxide					5696		
Marine Harvest Canada	211	Sonora Island, Oksollo Channel	1403325	3-2	JAN	Atlantic Salmon		Production	2013					Enamectin					948.8		
Marine Harvest Canada	211	Sonora Island, Oksollo Channel	1403325	3-2	FEB	Atlantic Salmon		Production	2014					Enamectin					0.277		
Marine Harvest Canada	211	Sonora Island, Oksollo Channel	1403325	3-2	FEB	Atlantic Salmon		Production	2014					Enamectin					0.49062		
Marine Harvest Canada	211	Sonora Island, Oksollo Channel	1403325	3-2	OCT	Atlantic Salmon		Production	2014					Enamectin					0.82455		
Marine Harvest Canada	211	Sonora Island, Oksollo Channel	1403325	3-2	AUG	Atlantic Salmon		Production	2015					Enamectin					0.287035		
Marine Harvest Canada	211	Sonora Island, Oksollo Channel	1403325	3-2	SEP	Atlantic Salmon		Production	2015					Enamectin					1.2589009		
Marine Harvest Canada	227	Vantage Point, Sechart Inlet	2402095	3-1	JAN	Atlantic Salmon		Production	2015					Enamectin					0.11921		
Marine Harvest Canada	227	Bawden Point, Herbert Inlet	1403647	2-3	MAY	Atlantic Salmon		Production	2014					Enamectin					0.537		
Marine Harvest Canada	227	Bawden Point, Herbert Inlet	1403647	2-3	SEP	Atlantic Salmon		Production	2015					Enamectin					0.092		
Marine Harvest Canada	234	Dixon Point, Shelter Inlet	1403647	2-3	FEB	Atlantic Salmon		Production	2015					Enamectin					0.3311		
Marine Harvest Canada	234	Dixon Point, Shelter Inlet	1403293	2-3	MAY	Atlantic Salmon		Production	2013					Enamectin					0.118		
Marine Harvest Canada	304	Raza Island, Raza Passage	1403293	3-2	OCT	Atlantic Salmon		Production	2015					Enamectin					0.506		
Marine Harvest Canada	306	Venture Point, Sonora Island	1403267	3-2	MAR	Atlantic Salmon		Production	2013					Enamectin					0.62832		
Marine Harvest Canada	306	Venture Point, Sonora Island	1403267	3-2	FEB	Atlantic Salmon		Production	2014					Enamectin					0.292		
Marine Harvest Canada	306	Venture Point, Sonora Island	1403267	3-2	JUL	Atlantic Salmon		Production	2014					Enamectin					0.83325		
Marine Harvest Canada	306	Venture Point, Sonora Island	1403267	3-2	AUG	Atlantic Salmon		Production	2013					Enamectin					0.075		
Marine Harvest Canada	790	Chancellor Channel, West Thurlow Island	1403267	3-2	SEP	Atlantic Salmon		Production	2015					Enamectin					0.218		
Marine Harvest Canada	871	Barrier Bay, Sonora Island	1405245	3-2	NOV	Atlantic Salmon		Production	2016					Enamectin					0.6089		
Marine Harvest Canada	314	Ross Pass, Northeast Mckay Island	1405933	3-2	MAY	Atlantic Salmon		Production	2015					Enamectin					0.5558		
Marine Harvest Canada	314	Ross Pass, Northeast Mckay Island	1405933	2-3	SEP	Atlantic Salmon		Production	2013					Enamectin					0.109		
Marine Harvest Canada	314	Ross Pass, Northeast Mckay Island	1405933	2-3	SEP	Atlantic Salmon		Production	2013					Enamectin					0.137		
Marine Harvest Canada	306	Venture Point, Sonora Island	1403267	3-2	OCT	Atlantic Salmon		Production	2015					Enamectin					0.409		
Marine Harvest Canada	314	Venture Point, Sonora Island	1403267	3-2	MAR	Atlantic Salmon		Production	2016					Enamectin					0.245		
Marine Harvest Canada	332	Venture Point, Sonora Island	1403267	3-2	APR	Atlantic Salmon		Production	2016					Enamectin					0.84		
Marine Harvest Canada	380	Ross Pass, Northeast Mckay Island	1403144	3-2	FEB	Atlantic Salmon		Production	2015					Enamectin					0.1569204		
Marine Harvest Canada	380	Sallen, Northwest Sechart Inlet	2402424	3-1	SEP	Atlantic Salmon		Production	2016					Enamectin					0.875187		
Marine Harvest Canada	380	Sonora Pt., Noddies Channel	1403144	3-2	FEB	Atlantic Salmon		Production	2015					Enamectin					0.002352		
Marine Harvest Canada	821	Sonora Pt., Noddies Channel	1403144	3-2	DEC	Atlantic Salmon		Production	2015					Enamectin					0.8408		
Marine Harvest Canada	1059	Glacial Falls, Watson Cove, Tribune Channel	1405180	3-3	JAN	Atlantic Salmon		Production	2014					Enamectin					0.27825		
Marine Harvest Canada	1145	Potts Bay, Midsummer Island	1403328	3-3	JAN	Atlantic Salmon		Production	2014					Enamectin					1.3608		
Marine Harvest Canada	1145	Swanson Island, North side	1404381	3-3	JAN	Atlantic Salmon		Production	2013					Enamectin					0.01258		
Marine Harvest Canada	465	Swanson Island, North side	1404381	3-3	JAN	Atlantic Salmon		Production	2013					Enamectin					0.213		
Marine Harvest Canada	1618	Humphrey Rock, Tribune Channel	1409707	3-3	NOV	Atlantic Salmon		Production	2014					Enamectin					1.07696199		
Marine Harvest Canada	1145	Potts Bay, Midsummer Island	1406555	3-3	NOV	Atlantic Salmon		Production	2013					Enamectin					1.09446		
Marine Harvest Canada	820	Wicklow Point, Broughton Island	1405183	3-3	NOV	Atlantic Salmon		Production	2014					Enamectin					0.036038		
Marine Harvest Canada	1288	Doyle Island, Gordon Group	1407325	3-4	DEC	Atlantic Salmon		Production	2014					Enamectin					0.381175		
Marine Harvest Canada	1283	Duncan Island, Goleas Channel	1407325	3-4	DEC	Atlantic Salmon		Production	2014					Enamectin					0.264		
Marine Harvest Canada	570	Bedwell, East Shore	1403960	2-3	JUL	Atlantic Salmon		Production	2015					Enamectin					0.69181236		
Marine Harvest Canada	570	Bedwell, East Shore	1403960	2-3	DEC	Atlantic Salmon		Production	2015					Enamectin					0.285		
Marine Harvest Canada	526	Rant Point, Clayoquot Sound	1403262	2-3	JUL	Atlantic Salmon		Production	2014					Enamectin					0.64		
Marine Harvest Canada	526	Rant Point, Clayoquot Sound	1403262	2-3	JUL	Atlantic Salmon		Production	2013					Enamectin					0.593		
Marine Harvest Canada	527	Saranac Island, NW of Meares Island	1401590	2-3	MAY	Atlantic Salmon		Production	2015					Enamectin					0.638		
Marine Harvest Canada	527	Saranac Island, NW of Meares Island	1401590	2-3	MAY	Atlantic Salmon		Production	2013					Enamectin					0.406		
Marine Harvest Canada	527	Saranac Island, NW of Meares Island	1401590	2-3	AUG	Atlantic Salmon		Production	2013					Enamectin					0.66		
Marine Harvest Canada	1697	Culloden Point, Jarvis Inlet	2408043	3-1	MAY	Atlantic Salmon		Production	2015					Enamectin					0.643		
Marine Harvest Canada	540	Fortune Channel, East side Warm Bay	1403914	2-3	JUN	Atlantic Salmon		Production	2016					Enamectin					0.34125		
Marine Harvest Canada	540	Fortune Channel, East side Warm Bay	1403914	2-3	JUN	Atlantic Salmon		Production	2015					Enamectin					0.706		

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Company	Facility Reference No	Facility Name	Landfile No	Fish Health Zone	Calendar Month	Species	Notes	Year	Fish Health Category	Veterinary Diagnosis	Occurrence Category	Mitigative Action	Therapies Used (and Completed)	Other Therapies - Notes	Brand Name	Drug Identifier Number (DIN)	Dosage (Dose & Duration)	Weight of Active Therapeutics used (kg)	Anaesthetic Used During Month	Anaesthetic (g)
Marine Harvest Canada	892	Goleats Channel, S.E. Bell Island	1404318	3-4	NOV	Atlantic Salmon	Production	2014					Enamectin					0.1984		
Marine Harvest Canada	831	Shelter Passage, Wharfedale Island	1404091	3-4	OCT	Atlantic Salmon	Production	2014					Enamectin					0.316476		
Marine Harvest Canada	303	Glacial Creek, near Jarvis Inlet	2402751	3-1	FEB	Atlantic Salmon	Brood	2016					Enamectin					0.063256		
Marine Harvest Canada	1351	Marsh Bay, Stuart Rock N. of P. Hardy	1407749	3-4	SEP	Atlantic Salmon	Production	2014					Enamectin					1.14756992		
Cermaq	543	Mussel Rock, Clayouquot Sound	1401589	2-3	JUL	Atlantic Salmon	Production	2013					Enamectin					0.305		
Cermaq	543	Mussel Rock, Clayouquot Sound	1401589	2-3	JUL	Atlantic Salmon	Production	2015					Enamectin					0.313		
Cermaq	543	Mussel Rock, Clayouquot Sound	1401589	2-3	DEC	Atlantic Salmon	Production	2015					Enamectin					0.704		
Cermaq	819	Cecil Island, Greenway Sound	1405181	3-3	APR	Atlantic Salmon	Brood	2015					Enamectin					0.124		
Marine Harvest Canada	1702	Goat Cove, Roderick Island	6407324	3-5	MAR	Atlantic Salmon	Production	2016					Hydrogen Peroxide					4498		
Marine Harvest Canada	1702	Goat Cove, Roderick Island	6407324	3-5	FEB	Atlantic Salmon	Production	2016					Hydrogen Peroxide					33602		
Marine Harvest Canada	1702	Goat Cove, Roderick Island	6407324	3-5	MAY	Atlantic Salmon	Production	2016					Enamectin					1.05672		
Marine Harvest Canada	1145	Potts Bay, Midsummer Island	1406655	3-3	APR	Atlantic Salmon	Brood	2015					Enamectin					0.068394		
Cermaq	728	Sir Edmund Bay, NE Shore Broughton Inlet	1404179	3-3	MAR	Atlantic Salmon	Production	2013					Enamectin					0.9697		
Marine Harvest Canada	733	Cyrus Rocks	1406292	3-2	JAN	Atlantic Salmon	Production	2013					Enamectin					0.26854		
Marine Harvest Canada	1300	Althorpe, Sunderland Channel	1407426	3-3	APR	Atlantic Salmon	Production	2013					Enamectin					0.9697		
Marine Harvest Canada	1300	Althorpe, Sunderland Channel	1407426	3-3	DEC	Atlantic Salmon	Production	2015					Enamectin					1.3446		
Marine Harvest Canada	465	Swanson Island, North side	1404381	3-3	FEB	Atlantic Salmon	Production	2015					Enamectin					0.5585		
Greg Seafood	746	Site 13, Sechart Inlet	2402591	3-1	SEP	Atlantic Salmon	Production	2015					Enamectin					0.0748475		
Marine Harvest Canada	527	Sprancin Island, NW of Meares Island	1401590	2-3	JUL	Atlantic Salmon	Production	2016	Event	Sea Lice	New *	II pens treat	Enamectin			SLICE	2328216	µg/kg/ish/day for	0.06	
Marine Harvest Canada	1580	Jackson Passage S. of Finlayson Channel	6406814	3-5	JUN	Atlantic Salmon	Production	2016					Hydrogen Peroxide					2360		
Cermaq	819	Cecil Island, Greenway Sound	1405181	3-3	JUN	Atlantic Salmon	Production	2013					Enamectin					0.05		
Marine Harvest Canada	467	Midsummer Island, Spring Passage	1404380	3-3	FEB	Atlantic Salmon	Production	2015					Enamectin					1.23757		
Marine Harvest Canada	1580	Jackson Passage S. of Finlayson Channel	6406814	3-5	OCT	Atlantic Salmon	Production	2016	Event	Sea Lice treatment	New *	II pens treat	Enamectin		Paramove 50		1200ppm; 20 min	30799.5	TMS	
Marine Harvest Canada	1586	Doctor Point, Broughton Island	1408758	3-3	FEB	Atlantic Salmon	Production	2015					Enamectin					0.44648724		
Marine Harvest Canada	1591	Wicklow Point, Broughton Island	1405183	3-3	JUL	Atlantic	Production	2015					Enamectin					3.1131178		
Marine Harvest Canada	1691	Kid Bay, Roderick Island	6406984	3-5	FEB	Atlantic Salmon	Production	2016					Hydrogen Peroxide					2290		
Marine Harvest Canada	1691	Kid Bay, Roderick Island	6406984	3-5	MAR	Atlantic Salmon	Production	2016					Hydrogen Peroxide					52965.5		
Marine Harvest Canada	821	Glacial Falls, Watson Cove, Tribune Channel	1405180	3-3	JUN	Atlantic Salmon	Production	2015					Enamectin					0.1467064		
Marine Harvest Canada	728	Sir Edmund Bay, NE Shore Broughton Inlet	1404179	3-3	MAR	Atlantic Salmon	Production	2015					Enamectin					0.375		
Marine Harvest Canada	100	Lees Bay, N. Shore, West Thurlow Is.	1401949	3-2	MAY	Atlantic Salmon	Production	2016					Hydrogen Peroxide					7113		
Marine Harvest Canada	100	Lees Bay, N. Shore, West Thurlow Is.	1401949	3-2	JUN	Atlantic Salmon	Production	2016					Enamectin					0.00803		
Marine Harvest Canada	141	Lees Bay, N. Shore, West Thurlow Is.	1403104	3-3	MAY	Atlantic Salmon	Production	2016					Enamectin			SLICE	02328216	8 mg EMV/kg; 7 d	0.8629202	TMS
Marine Harvest Canada	1144	Port Elizabeth, Gifford Island	1406650	3-3	MAY	Atlantic Salmon	Production	2015					Enamectin					0.33		
Marine Harvest Canada	1288	Burdwood Group, Raleigh Passage	1407325	3-4	JUL	Atlantic Salmon	Production	2015					Enamectin					0.542		
Cermaq	869	Doyle Island, Gordon Group	1405739	3-3	MAR	Atlantic Salmon	Production	2013					Enamectin					0.81381885		
Greg Seafood	1863	Maude Island, SE Broughton Is.,	1405739	3-3	SEP	Atlantic Salmon	Production	2013					Enamectin					0.1973		
Greg Seafood	871	Esperanza, Hecla Channel	1411181	2-4	SEP	Atlantic Salmon	Production	2014					Enamectin			SLICE	2328216	0.4		189
Greg Seafood	871	Barnes Bay, Sonora Island	1405542	3-2	NOV	Atlantic Salmon	Production	2014					Enamectin					0.9575		
Greg Seafood	871	Barnes Bay, Sonora Island	1405542	3-2	DEC	Atlantic Salmon	Production	2014					Enamectin					0.9654		
Greg Seafood	871	Barnes Bay, Sonora Island	1405542	3-2	AUG	Atlantic Salmon	Production	2014					Enamectin					0.4684		
Greg Seafood	871	Barnes Bay, Sonora Island	1405542	3-2	OCT	Atlantic Salmon	Production	2015					Enamectin					0.36		
Marine Harvest Canada	884	Lochalsh Bay, Jackson Passage	6403484	3-5	JAN	Atlantic Salmon	Production	2014					Enamectin					0.10881		
Marine Harvest Canada	884	Lochalsh Bay, Jackson Passage	6403484	3-5	JAN	Atlantic Salmon	Production	2015					Enamectin					0.03013		
Marine Harvest Canada	884	Lochalsh Bay, Jackson Passage	6403484	3-5	MAR	Atlantic Salmon	Production	2015					Enamectin					5126		
Marine Harvest Canada	892	Goleats Channel, S.E. Bell Island	1404918	3-4	NOV	Atlantic Salmon	Production	2013					Hydrogen Peroxide					0.1433949		
Marine Harvest Canada	1293	Duncan Island, Goleats Channel	1407326	3-4	JUL	Atlantic Salmon	Production	2015					Enamectin					1.2717177		
Marine Harvest Canada	1288	Doyle Island, Gordon Group	1407325	3-4	JUL	Atlantic Salmon	Production	2015					Enamectin					0.05246615		
Marine Harvest Canada	1079	Steamer Point, Hecla Channel	1404969	2-4	AUG	Atlantic Salmon	Production	2015					Enamectin					0.1833		
Greg Seafood	1079	Steamer Point, Hecla Channel	1404969	2-4	DEC	Atlantic Salmon	Production	2014					Enamectin					0.52143		
Cermaq	1144	Burdwood Group, Raleigh Passage	1407429	3-4	NOV	Atlantic Salmon	Production	2015					Enamectin					0.584		
Marine Harvest Canada	1351	Marish Bay, Stuart Rock N. of P. Hardy	1407429	3-4	NOV	Atlantic Salmon	Production	2015					Enamectin					0.38215		
Marine Harvest Canada	78	Phillips Arm, Cardero Channel	2403170	3-2	DEC	Atlantic Salmon	Production	2016	Event	Sea Lice Treatment	New *	II pens treat	Enamectin		SLICE	02328216	3.08 mg/kg; 7 day	0.502772	TMS	
Marine Harvest Canada	1145	Potts Bay, Midsummer Island	1406655	3-3	JAN	Atlantic Salmon	Brood	2013					Enamectin					0.05		
Marine Harvest Canada	141	Port Elizabeth, Gifford Island	1405180	3-3	FEB	Atlantic Salmon	Production	2015					Enamectin					0.2601945		
Marine Harvest Canada	467	Midsummer Island, Spring Passage	1404380	3-3	FEB	Atlantic Salmon	Production	2016					Enamectin					0.49384		
Marine Harvest Canada	821	Glacial Falls, Watson Cove, Tribune Channel	1405180	3-3	FEB	Atlantic Salmon	Production	2016					Enamectin					0.70602		
Marine Harvest Canada	1059	Sargeant Passage, Tribune Channel	1403328	3-3	FEB	Atlantic Salmon	Production	2016					Enamectin					0.37133644		
Marine Harvest Canada	1145	Potts Bay, Midsummer Island	1406655	3-3	FEB	Atlantic Salmon	Production	2016					Enamectin					0.0561968		
Marine Harvest Canada	1618	Humphrey Rock, Tribune Channel	1409707	3-3	FEB	Atlantic Salmon	Production	2016					Enamectin					0.1459009		
Marine Harvest Canada	1237	Monday Rocks, Quatsino Sound	1408960	2-4	FEB	Atlantic Salmon	Production	2013					Enamectin					0.1338		

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Company	Facility Reference No	Facility Name	Landfill No	Fish Health Zone	Calendar Month	Species	Notes	Brood / Production	Year	Fish Health Category	Veterinary Diagnosis	Occurrence Category	Mitigative Action	Therapeutant Used (and Completed)	Other Therapeutants - Notes	Brand Name	Drug Identifier Number (DIN)	Dosage (Dose & Duration)	Weight of Therapeutant used (kg)	Anaesthetic Used During Month	Anaesthetic (g)
Marine Harvest Canada	1237	Monday Rocks, Quatsino Sound	1406960	2-4	NOV	Atlantic Salmon		Production	2013					Enamectin					0.5138845		
Marine Harvest Canada	1237	Monday Rocks, Quatsino Sound	1406960	2-4	FEB	Atlantic Salmon		Production	2014					Enamectin					1.03309		
Marine Harvest Canada	1237	Monday Rocks, Quatsino Sound	1406960	2-4	APR	Atlantic Salmon		Production	2015					Enamectin					0.20793		
Marine Harvest Canada	1237	Monday Rocks, Quatsino Sound	1406960	2-4	MAR	Atlantic Salmon		Production	2015					Hydrogen Peroxide					5602		
Marine Harvest Canada	1237	Monday Rocks, Quatsino Sound	1406960	2-4	JUL	Atlantic Salmon		Production	2015					Hydrogen Peroxide					972		
Marine Harvest Canada	1238	Mahatta West, Koskimo Islands, Quatsino Sound	1406961	2-4	APR	Atlantic Salmon		Production	2013					Enamectin					0.657504		
Marine Harvest Canada	1238	Mahatta West, Koskimo Islands, Quatsino Sound	1406961	2-4	FEB	Atlantic Salmon		Production	2014					Enamectin					0.07524		
Marine Harvest Canada	1238	Mahatta West, Koskimo Islands, Quatsino Sound	1406961	2-4	NOV	Atlantic Salmon		Production	2014					Enamectin					0.43232		
Marine Harvest Canada	1145	Potts Bay, Midsummer Island	1406655	3-3	JAN	Atlantic Salmon		Brood	2016					Enamectin					0.01887		
Marine Harvest Canada	821	Glacial Falls, Watson Cove, Tribune Channel	1405180	3-3	JUN	Atlantic Salmon		Production	2016					Enamectin					0.001338		
Marine Harvest Canada	1059	Sargeant Passage, Tribune Channel	1403328	3-3	MAR	Atlantic Salmon		Production	2016					Enamectin					1.4235025		
Marine Harvest Canada	1618	Humphrey Rock, Tribune Channel	1409707	3-3	MAR	Atlantic Salmon		Production	2016					Enamectin					1.0693		
Marine Harvest Canada	1586	Doctor Islets, Knight Inlet	1408758	3-3	MAY	Atlantic Salmon		Production	2016					Enamectin					0.0501		
Marine Harvest Canada	1338	2km NE of Mahatta River, Quatsino Sound	1403748	2-4	MAY	Atlantic Salmon		Production	2013					Enamectin					0.55275		
Marine Harvest Canada	1338	2km NE of Mahatta River, Quatsino Sound	1403748	2-4	MAR	Atlantic Salmon		Production	2014					Enamectin					0.11697		
Marine Harvest Canada	1338	2km NE of Mahatta River, Quatsino Sound	1403748	2-4	NOV	Atlantic Salmon		Production	2014					Enamectin					0.65		
Marine Harvest Canada	1350	Shelter Bay, Richards Channel	1407748	3-4	DEC	Atlantic Salmon		Production	2013					Enamectin					0.52041		
Marine Harvest Canada	1581	Hardwicke Is, Site B, Chancellor Channel	1409321	3-3	NOV	Atlantic Salmon		Production	2016			New *	Il pens treat	Enamectin			SLICE	0.08 mg EMB/kg, 7 d	0.52041	TMS	
Marine Harvest Canada	831	Shelter Passage, Wishart Island	1404091	3-4	DEC	Atlantic Salmon		Production	2016			New *	Il pens treat	Hydrogen Peroxide			Paramove 50	1200 ppm, 20 min	4399.5	TMS	
Cermaq	1401	Brent Island, Oksillo Channel	1407983	3-2	AUG	Atlantic Salmon		Production	2013					Enamectin					0.11		
Cermaq	1401	Brent Island, Oksillo Channel	1407983	3-2	FEB	Atlantic Salmon		Production	2014					Enamectin					0.43		
Cermaq	1401	Brent Island, Oksillo Channel	1407983	3-2	JUL	Atlantic Salmon		Production	2014					Enamectin					0.94435		
Cermaq	1401	Brent Island, Oksillo Channel	1407983	3-2	SEP	Atlantic Salmon		Production	2015					Enamectin					0.199		
Cermaq	1148	Binns Island, Herbert Inlet	1406648	2-3	MAR	Atlantic Salmon		Production	2016					Enamectin					0.0777		
Cermaq	1507	Millar Channel, 2km S Hayden Passage	1408719	2-3	MAY	Atlantic Salmon		Production	2013					Enamectin					0.056		
Cermaq	1507	Millar Channel, 2km S Hayden Passage	1408719	2-3	AUG	Atlantic Salmon		Production	2013					Enamectin					0.254		
Cermaq	1507	Millar Channel, 2km S Hayden Passage	1408719	2-3	MAY	Atlantic Salmon		Production	2014					Enamectin					0.386		
Cermaq	1507	Millar Channel, 2km S Hayden Passage	1408719	2-3	SEP	Atlantic Salmon		Production	2015					Enamectin					0.399		
Cermaq	1401	Brent Island, Oksillo Channel	1407983	3-2	MAR	Atlantic Salmon		Production	2016					Enamectin					0.1965		
Cermaq	1401	Brent Island, Oksillo Channel	1407983	3-2	APR	Atlantic Salmon		Production	2016					Enamectin					0.8		
Cermaq	1401	Brent Island, Oksillo Channel	1407983	3-2	Oct	Atlantic Salmon		Production	2014					Enamectin					0.02817408		
Marine Harvest Canada	1580	Jackson Passage S of Finlayson Channel	1409814	3-5	Oct	Atlantic Salmon		Production	2016					Enamectin					0.241		
Marine Harvest Canada	1581	Hardwicke Is, Site B, Chancellor Channel	1409321	3-2	JAN	Atlantic Salmon		Production	2013					Enamectin					1.1322		
Marine Harvest Canada	1581	Hardwicke Is, Site B, Chancellor Channel	1409321	3-2	DEC	Atlantic Salmon		Production	2013					Enamectin					0.0629		
Marine Harvest Canada	1581	Hardwicke Is, Site B, Chancellor Channel	1409321	3-2	JAN	Atlantic Salmon		Production	2015					Enamectin					0.88243		
Marine Harvest Canada	1581	Hardwicke Is, Site B, Chancellor Channel	1409321	3-2	APR	Atlantic Salmon		Production	2015					Enamectin					1.41376		
Marine Harvest Canada	1581	Hardwicke Is, Site B, Chancellor Channel	1409321	3-2	DEC	Atlantic Salmon		Production	2015					Enamectin					0.313		
Marine Harvest Canada	1586	Doctor Islets, Knight Inlet	1408758	3-4	JAN	Atlantic Salmon		Production	2013					Enamectin					5990		
Marine Harvest Canada	1288	Doyle Island, Gordon Group	1407325	3-4	DEC	Atlantic Salmon		Production	2016			New *	Il pens treat	Hydrogen Peroxide			Paramove 50	1200 ppm, 20 min	0.165	TMS	165
Cermaq	1472	West Side, Bedwell Sound	1408492	2-3	MAY	Atlantic Salmon		Production	2016					Enamectin					0.363		
Cermaq	1507	Millar Channel, 2km S Hayden Passage	1408719	2-3	APR	Atlantic Salmon		Production	2016					Enamectin					0.545		
Cermaq	1537	Bare Bluff, Claycoquet Snd, Bedwell Snd	1403979	2-3	MAY	Atlantic Salmon		Production	2016					Enamectin					0.474		
Marine Harvest Canada	7053	Ghi Vya, Bull Harbour, Hope Isl	1414224	3-4	MAR	Atlantic Salmon		Production	2016					Enamectin			SLICE	2328216	0.08		
Marine Harvest Canada	1350	Shelter Bay, Richards Channel	1407748	3-4	MAR	Atlantic Salmon		Production	2016					Enamectin					1.127439		
Marine Harvest Canada	1895	Ghi Vya, Bull Harbour, Hope Isl	1414224	3-5	MAR	Atlantic Salmon		Production	2016					Hydrogen Peroxide					0.854436		
Marine Harvest Canada	1691	Sheep Passage in vicinity of Poolley Isl.	6407839	3-5	APR	Atlantic Salmon		Production	2016					Hydrogen Peroxide					35702		
Marine Harvest Canada	1691	Kid Bay, Roderick Island	6406984	3-5	SEP	Atlantic Salmon		Production	2013					Enamectin					5890		
Marine Harvest Canada	1691	Kid Bay, Roderick Island	6406984	3-5	JAN	Atlantic Salmon		Production	2013					Enamectin					0.309		
Marine Harvest Canada	1691	Kid Bay, Roderick Island	6406984	3-5	MAR	Atlantic Salmon		Production	2014					Hydrogen Peroxide					0.06088		
Marine Harvest Canada	1691	Kid Bay, Roderick Island	6406984	3-5	JUN	Atlantic Salmon		Production	2014					Enamectin					33831		
Marine Harvest Canada	1691	Kid Bay, Roderick Island	6406984	3-5	JUL	Atlantic Salmon		Production	2015					Enamectin					0.04018068		
Marine Harvest Canada	1691	Kid Bay, Roderick Island	6406984	3-5	NOV	Atlantic Salmon		Production	2015					Enamectin					0.43783283		
Marine Harvest Canada	1691	Kid Bay, Roderick Island	6406984	3-5	NOV	Atlantic Salmon		Production	2015					Enamectin					0.9129896		
Marine Harvest Canada	1691	Kid Bay, Roderick Island	6406984	3-5	OCT	Atlantic Salmon		Production	2015					Hydrogen Peroxide					33657.5		
Marine Harvest Canada	1895	Sheep Passage in vicinity of Poolley Isl.	6407839	3-5	MAY	Atlantic Salmon		Production	2016					Hydrogen Peroxide					0.05		
Marine Harvest Canada	1895	Sheep Passage in vicinity of Poolley Isl.	6407839	3-5	JUN	Atlantic Salmon		Production	2016					Enamectin					0.37665		
Marine Harvest Canada	1895	Culloden Point, Jarvis Inlet	2408043	3-1	OCT	Atlantic Salmon		Production	2015					Enamectin					0.161		
Marine Harvest Canada	1895	Sheep Passage in vicinity of Poolley Isl.	6407839	3-5	NOV	Atlantic Salmon		Production	2016			New *	Il pens treat	Hydrogen Peroxide			Paramove 50	1200 ppm, 20 min	37892	TMS	
Marine Harvest Canada	1895	Sheep Passage in vicinity of Poolley Isl.	6407839	3-5	DEC	Atlantic Salmon		Production	2016			New *	Il pens treat	Hydrogen Peroxide			Paramove 50	1200 ppm, 20 min	21552	TMS	
Marine Harvest Canada	1351	Marsh Bay, Stuart Rock, N. of P. Hardy	1407749	3-4	MAY	Atlantic Salmon		Production	2016					Enamectin					0.0817		
Marine Harvest Canada	1698	Ahlstrom Point, Jarvis Inlet	2408042	3-1	FEB	Atlantic Salmon		Production	2014					Enamectin					0.0731		

s. 20(1)(b)

Company	Facility Reference No	Facility Name	Landfill No	Fish Health Zone	Calendar Month	Species	Nores	Brood/ Production	Year	Fish Health Category	Veterinary Diagnosis	Occurrence Category	Mitigative Action	Therapeutant, Pest Control Product Used (and Completed)	Other Theraputants - Notes	Brand Name	Drug Identifier Number (DIN)	Dosage (Dose & Duration)	Weight of Active Theraputants used (kg)	Anaesthetic Used During Month	Anaesthetic (g)
Greg Seafood	1698	Abitom Point, Jarvis Inlet	248042	3-1	OCT	Atlantic Salmon		Production	2015					Enamectin			Enamectin		0.329		
Greg Seafood	1700	Muchalat Inlet South, Nootka District	1411064	2-4	JAN	Atlantic Salmon		Production	2013					Enamectin			Enamectin		0.525		
Greg Seafood	1700	Muchalat Inlet South, Nootka District	1411064	2-4	SEP	Atlantic Salmon		Production	2014					Enamectin			Enamectin		0.3367		
Greg Seafood	1700	Muchalat Inlet South, Nootka District	1411064	2-4	FEB	Atlantic Salmon		Production	2015					Enamectin			Enamectin		0.24978		
Greg Seafood	1700	Muchalat Inlet South, Nootka District	1411064	2-4	MAR	Atlantic Salmon		Production	2015					Enamectin			Enamectin		0.52		
Marine Harvest Canada	1702	Goat Cove, Roderich Island	6407324	3-5	JAN	Atlantic Salmon		Production	2014					Enamectin			Enamectin		0.52836		
Marine Harvest Canada	1702	Goat Cove, Roderich Island	6407324	3-5	NOV	Atlantic Salmon		Production	2015					Enamectin			Enamectin		0.7315		
Marine Harvest Canada	1702	Goat Cove, Roderich Island	6407324	3-5	NOV	Atlantic Salmon		Production	2015	Event	as Lice Treatment On-going ** - dead pens tre			Hydrogen Peroxide	Peroxide, in L not kg	Paramove 50		1200 ppm; 20 min	12932	TMS	
Marine Harvest Canada	1388	Doyle Island, Gordon Group	1407325	3-4	OCT	Atlantic Salmon		Production	2016					Enamectin			Enamectin		0.098		
Marine Harvest Canada	1705	Williamson Passage, Nootka Sound	1411068	2-4	AUG	Atlantic Salmon		Production	2015					Enamectin			Enamectin		0.80512		
Marine Harvest Canada	211	Sonora Island, Okefino Channel	1403325	3-2	APR	Atlantic Salmon		Production	2016					Hydrogen Peroxide		Paramove 50	31393	1200	12781	TMS	
Marine Harvest Canada	1738	Atrevida Point, Hannu Channel	1403325	3-2	SEP	Atlantic Salmon		Production	2016					Enamectin			Enamectin		0.3358		
Marine Harvest Canada	380	Sonora Pt., Noddas Channel	1403144	3-2	AUG	Atlantic Salmon		Production	2016					Hydrogen Peroxide		Paramove 50	31393	1200	8236.5	TMS	
Marine Harvest Canada	380	Sonora Pt., Noddas Channel	1403144	3-2	DEC	Atlantic Salmon		Production	2016	Event	as Lice Treatment	New * II pens treat		Enamectin		SLICE	02228216	3.08 mg/kg; 7 day	0.4950072	TMS	
Greg Seafood	1789	Concession Pt., Bligh Island	1405534	2-4	OCT	Atlantic Salmon		Production	2013					Enamectin			Enamectin		0.17		
Greg Seafood	1789	Concession Pt., Bligh Island	1405534	2-4	MAR	Atlantic Salmon		Production	2015					Enamectin			Enamectin		0.3864		
Greg Seafood	1825	Bennett Point, Clio Channel	1411154	3-3	AUG	Atlantic Salmon		Production	2015					Enamectin			Enamectin		0.3006		
Marine Harvest Canada	1293	Duncan Island, Goletas Channel	1407326	3-4	FEB	Atlantic Salmon		Production	2013	Event	as Lice treatment	New * - dead pens tre		Hydrogen Peroxide		Paramove 50	31393	1200 ppm; 20 min	28540	TMS	
Marine Harvest Canada	1293	Duncan Island, Goletas Channel	1407326	3-4	OCT	Atlantic Salmon		Production	2016					Hydrogen Peroxide		Paramove 50	31393	1200	15928	TMS	
Marine Harvest Canada	1079	Skanner Point, Hezeta Channel	1404869	2-4	SEP	Atlantic Salmon		Production	2016	Event	Sea Lice	New *		Enamectin		SLICE	2328216		0.3875	TMS	115
Greg Seafood	1849	Muchalat Inlet North, Nootka Sound	1411168	2-4	SEP	Atlantic Salmon		Production	2014					Enamectin			Enamectin		0.1113		
Greg Seafood	1849	Muchalat Inlet North, Nootka Sound	1411168	2-4	MAR	Atlantic Salmon		Production	2015					Enamectin			Enamectin		0.78164		
Greg Seafood	1849	Muchalat Inlet North, Nootka Sound	1411168	2-4	FEB	Atlantic Salmon		Production	2015					Enamectin			Enamectin		0.208		
Greg Seafood	1577	Bare Bluff, Clavouquet Snd, Bekwell Snd	1403979	2-3	APR	Atlantic Salmon		Production	2016					Enamectin			Enamectin		0.2262		
Greg Seafood	1863	Emeranza, Hezeta Channel	1411181	2-4	AUG	Atlantic Salmon		Production	2014					Enamectin			Enamectin		0.65247		
Marine Harvest Canada	1895	Sheep Passage in vicinity of Pooley Isl	6407839	3-5	DEC	Atlantic Salmon		Production	2014					Enamectin			Enamectin		0.234628		
Marine Harvest Canada	1895	Sheep Passage in vicinity of Pooley Isl	6407839	3-5	OCT	Atlantic Salmon		Production	2013					Enamectin			Enamectin		0.90471582		
Marine Harvest Canada	1895	Sheep Passage in vicinity of Pooley Isl	6407839	3-5	NOV	Atlantic Salmon		Production	2013					Enamectin			Enamectin		1.0073		
Marine Harvest Canada	1895	Sheep Passage in vicinity of Pooley Isl	6407839	3-5	FEB	Atlantic Salmon		Production	2013					Enamectin			Enamectin		1.3838		
Marine Harvest Canada	1895	Sheep Passage in vicinity of Pooley Isl	6407839	3-5	MAY	Atlantic Salmon		Production	2013					Enamectin			Enamectin		0.63294		
Marine Harvest Canada	1896	Sheep Passage in vicinity of Pooley Isl	6407839	3-5	OCT	Atlantic Salmon		Production	2014					Enamectin			Enamectin		0.86		
Marine Harvest Canada	1896	Line Bay, vicinity of Pooley Island	6407840	3-5	APR	Atlantic Salmon		Production	2015					Enamectin			Enamectin		33880		
Marine Harvest Canada	6668	Lower Bay, vicinity of Pooley Island	6407840	3-5	MAY	Atlantic Salmon		Production	2015					Hydrogen Peroxide			Enamectin		0.165		
Marine Harvest Canada	6668	Plow Point, Fortune Channel	1413555	2-3	APR	Atlantic Salmon		Production	2015					Enamectin			Enamectin		0.5208		
Marine Harvest Canada	6668	Plow Point, Fortune Channel	1413555	2-3	SEP	Atlantic Salmon		Production	2015					Enamectin			Enamectin		0.705075	TMS	65
Marine Harvest Canada	1705	Williamson Passage, Nootka Sound	1411068	2-4	FEB	Atlantic Salmon		Production	2016					Enamectin			Enamectin				
Greg Seafood					APR	Atlantic Salmon		Production	2016					Enamectin			Enamectin				

s.20(1)(b)

Paylor, Adrienne

From: Paylor, Adrienne
Sent: June-13-17 2:15 PM
To: Calla, Karen
Subject: [REDACTED]

[REDACTED]

Adrienne

From: Calla, Karen
Sent: Tuesday, June 13, 2017 1:01 PM
To: Paylor, Adrienne
Subject: [REDACTED]

Could you please call me [REDACTED] Thanks, Karen

From: LaRue, Jean-François
Sent: Tuesday, June 13, 2017 10:08 AM
To: Calla, Karen <Karen.Calla@dfo-mpo.gc.ca>
Cc: Campbell, John P. <John.Campbell@dfo-mpo.gc.ca>; Struthers, Alistair <Alistair.Struthers@dfo-mpo.gc.ca>
Subject: [REDACTED]

Karen

[REDACTED]

Merci
JF

s.21(1)(a)
s.21(1)(b)
s.23

From: LaRue, Jean-François
Sent: Tuesday, June 13, 2017 1:02 PM
To: Campbell, John P. <John.Campbell@dfo-mpo.gc.ca>; Struthers, Alistair <Alistair.Struthers@dfo-mpo.gc.ca>
Cc: Lavigne, Joliane <Joliane.Lavigne@dfo-mpo.gc.ca>; Jones, Robert <Robert.Jones@dfo-mpo.gc.ca>; Hamel, Anne-Marie <Anne-Marie.Hamel@dfo-mpo.gc.ca>; Baldwin, Jennifer <Jennifer.Baldwin@dfo-mpo.gc.ca>
Subject: [REDACTED]

Salut

[Redacted]

JF

From: Morel, Philippe
Sent: Tuesday, June 13, 2017 12:58 PM
To: LaRue, Jean-François <Jean-Francois.LaRue@dfo-mpo.gc.ca>
Cc: Richter, Julie <Julie.Richter@dfo-mpo.gc.ca>
Subject: [Redacted]

Jean-Francois

[Redacted]

Philippe

Philippe Morel
ADM, Ecosystems and Fisheries Management
Fisheries and Oceans Canada
SMA, Gestion des Écosystèmes et des pêches
Pêches et Océans Canada

s.21(1)(a)

s.21(1)(b)

s.23

Tel: 613-993-1914

De: Sharzer, Stephen <Stephen.Sharzer@dfo-mpo.gc.ca>

Envoyé: mardi 13 juin 2017 12:52

À: Morel, Philippe

Cc: Richter, Julie; LaRue, Jean-François; Cossette, Patrick; Ikejiani, Alexander; Birba, Rose-Gabrielle

Objet: [Redacted]

Protected Solicitor-Client and Litigation Privilege

Philippe

[Redacted]

**Pages 204 to / à 206
are withheld pursuant to section
sont retenues en vertu de l'article**

23

**of the Access to Information Act
de la Loi sur l'accès à l'information**

Keith, Ian

From: Keith, Ian
Sent: June-21-17 12:56 AM
To: Paylor, Adrienne
Cc: Higgins, Mark
Subject: cementing arguments
Attachments: Jones Timing of treatment.docx; Copy of Broughton mean female_1.xlsx

My memory was right, that Marty et al. (2010) found that the interannual variation in female lice abundance on farmed fish during outmigration could be explained by size of the pink salmon run in the previous fall ($r^2=0.75$ for odd year run; $r^2=0.94$ for even year run, linear regression). So any model to predict sea lice prevalence must include size of the pink run and there is no claim to cause.

Likewise, interannual variation in prevalence of lice on outmigrating wild salmon smolts could be explained by abundance of female lice on farmed salmon; the relationship is curvilinear with an extremely high regression coefficient i.e. $r^2 = 0.98$. So again, no claim to cause; the farmed fish may be reflecting the lice presence in the environment.

I have constructed a curve of mean monthly female lice abundance on farmed Atlantic salmon in the Broughton for 2011-2017 using Krista's data (attached). I have constructed it because it suggests that [REDACTED] data is likely to show wild smolt prevalence to be higher than last year. And before assuming that it won't be as high as found in 2015, the timing of SLICE treatments in Broughton was delayed in this fall/winter, like in Fall 2015/Winter 2016 (attached) and Simon agrees [REDACTED] that this timing will change the lice population structure in the farmed fish which may affect prevalence in wild smolts.

In 2015 when we were dealing the consequences of the high return in Fall 2014 i.e. reaching threshold during outmigration in Broughton, those who were around for the high pink returns in Fall 2000 and 2001 warned that [REDACTED] would be more interested in Spring 2017. The reasons are that every time there is high return there is apparent collapse when the young from that spawning come back to spawn. There are models that the stock biologists have built and use so I think you are wise to stick to the data from the monitoring program, as you've done and stick to the lice questions.

IN this case, where Marine Harvest has its ability going forward, to implement integrated pest management with its mechanical lice removal and will be in a good position to argue for peroxide treatment in Broughton (where they can capture their lice from the well boat), we are not vulnerable as we were in the early 2000s.

Ian

Dr. Ian Keith DVM
Field Operations Veterinarian - Pacific Region
Fisheries and Oceans Canada | Pêches et Océans Canada
Fisheries Management
Aquaculture Management Division | Gestion de l'aquaculture
Aquaculture Environmental Operations - Fish Health
#103 - 2435 Mansfield Drive
Courtenay, British Columbia V9N 2M2
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Ian.Keith@dfo-mpo.gc.ca

s.16(2)(c)

s.19(1)

From: Keith, Ian
Sent: Tuesday, June 20, 2017 3:05 PM

To: Paylor, Adrienne

Subject: updates on industry options in the Broughton and pieces of response

Hi Adrienne,

Update: Marine Harvest received a brand new freshwater well boat which is in Menzies as I write. This is a rental from Intership that is to provide a wellboat ahead of MHC receiving their own new well boat in 2018Q1. Their mechanical Hydrolicer is being fitted on the local barge, to go into service in August. [REDACTED] his sense is that pesticide use permit for hydrogen peroxide in the Broughton will occur in Fall 2017, because of the importance of this option for alternate lice treatment that is recognised by all parties.

Regarding 2017 and the Broughton: The large runs of pink salmon in the Broughton are alternate years, with the dominant runs being in the fall of the even years, so we anticipated many lice from the wild pinks in Fall 2016 with the effects seen on the outmigrating pink smolts in Winter/Spring 2017.

I'm just double checking my memory, but my recollection is that Marty et al. (2010) found they could explain the year to year variation of female lice on farmed fish in the spring by the size of the pink salmon run in the previous fall. The regression coefficient for the regression of abundance on the farm and the size of the run was .8, which is a very large coefficient. Simon says that this alone does not explain the anomalous years but his independent assessment of the farm data and fall pink run size agreed with Marty et al. Most importantly, Marty et al. (2010) said that the abundance of female lice on farmed fish in the Broughton predicted prevalence of lice on outmigrating pink salmon. This doesn't mean that the farmed salmon were the source of the lice, although this can't be excluded as a source; the farmed salmon are a sentinel population to indicate how many lice are in the environment.

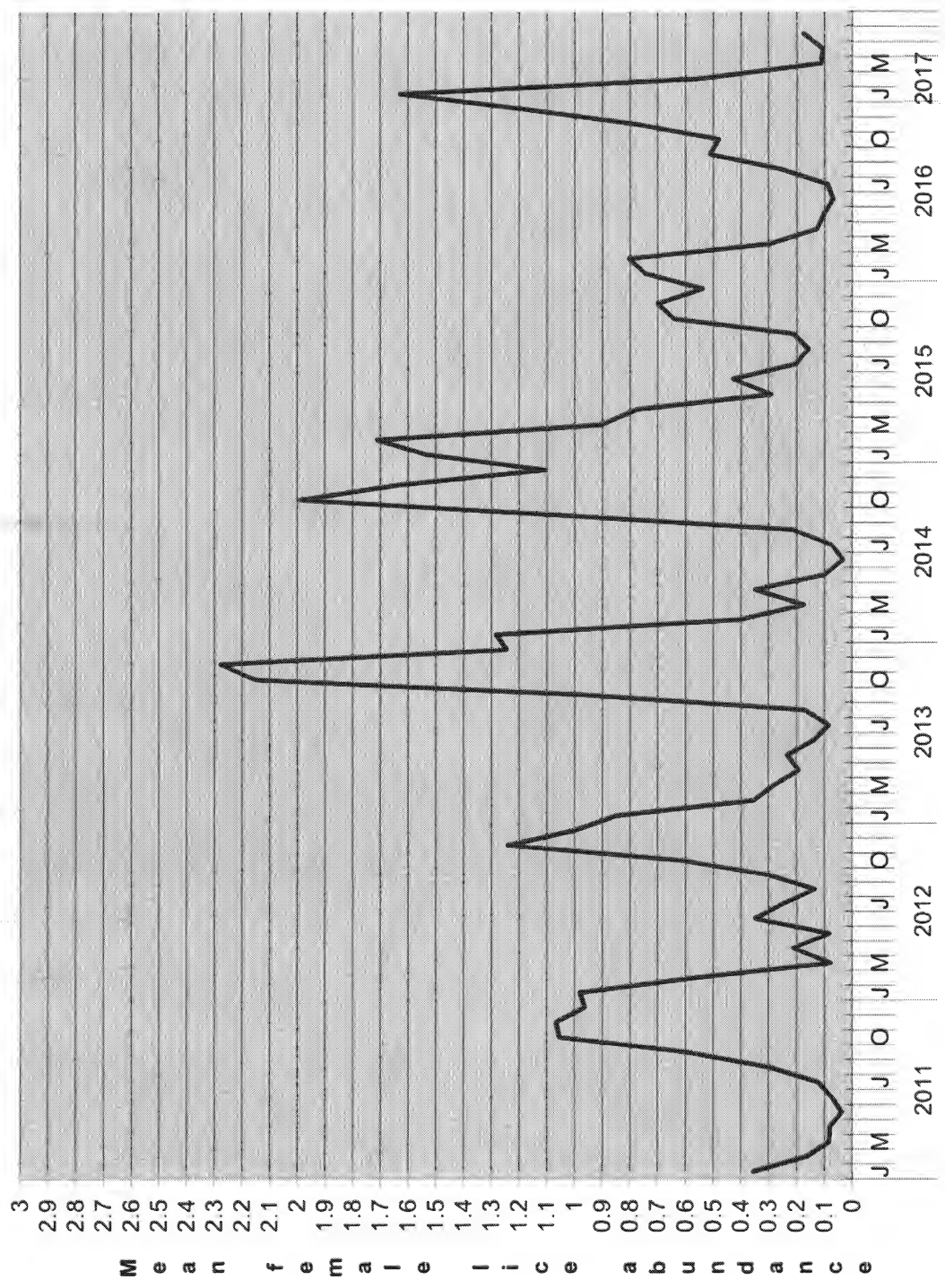
I have inserted the essence of the above in [REDACTED] letter as comments. I am right now preparing the 2017 graph to add to Krista's earlier year graphs but find that the mean female lice abundance on Broughton farms in Winter/Spring 2017 is lower than in 2015. We would therefore predict that the prevalence on outmigrating smolts would be lower than that found in 2015, which is counter to what [REDACTED] says in her letter.

Dr. Ian Keith DVM
Field Operations Veterinarian - Pacific Region
Fisheries and Oceans Canada | Pêches et Océans Canada
Fisheries Management
Aquaculture Management Division | Gestion de l'aquaculture
Aquaculture Environmental Operations - Fish Health
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Mobile | Portable: [REDACTED]
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s.16(2)(c)

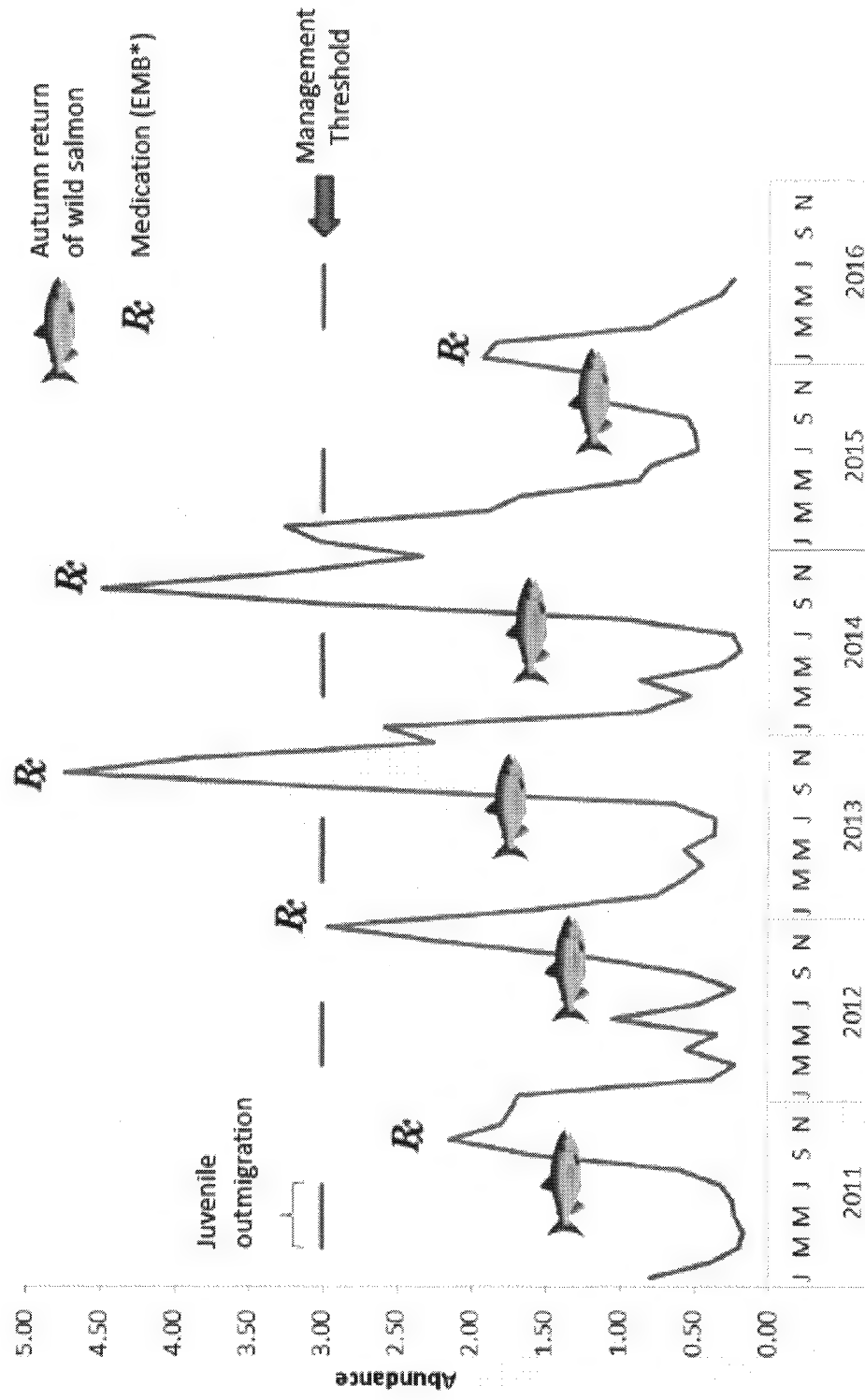
s.19(1)

Abundance of female sea lice at Atlantic salmon farms in fish health zone 3.3
 Monthly mean for the zone calculated from industry monitoring reports.
 Purpose: Female lice on farms is correlated with lice prevalence of wild smolts



Epidemiology and the management of motile

L. salmonis in British Columbia



Manchester, Howie

From: Charbonneau, Michelle
Sent: June-21-17 9:19 AM
To: Sandberg, Krista
Cc: Manchester, Howie
Subject: RE: Notification of Slice Treatments

That's an awesome idea. I love it. Could you please add that where ever you think we need context? If it's just that sheet, awesome. I mentioned it to Howie and I'll let our crew know to look for a read me tab whenever using your spreadsheets.

Michelle Charbonneau

Michelle.Charbonneau@dfo-mpo.gc.ca
Telephone | Téléphone 250-895-1724

From: Sandberg, Krista
Sent: Wednesday, June 21, 2017 9:16 AM
To: Charbonneau, Michelle
Subject: RE: Notification of Slice Treatments

That will be the only year where there should be any discrepancies, due to the implementation of the AAR. We could add a "READ ME" tab to any of those spreadsheets if there are any notes like that you want to make.

Krista Sandberg

telephone: 250 286 5835 telephone: 250 286 5835
cellular: [REDACTED] telephone, portable: [REDACTED]

From: Charbonneau, Michelle
Sent: Wednesday, June 21, 2017 9:11 AM
To: Sandberg, Krista
Subject: RE: Notification of Slice Treatments

Thanks for that Krista,

Are there other spreadsheets where context like this is necessary? Is there someplace where the context around these spreadsheets is captured? I didn't see anything in the SOP and the potential for error mining data is big. It was a fluke that we caught this. I think, if it isn't captured somewhere yet, that would be my recommendation for every spreadsheet we may use to capture or mine data. I've passed my concerns onto Howie to discuss with you.

Cheers,

Michelle Charbonneau

Michelle.Charbonneau@dfo-mpo.gc.ca
Telephone | Téléphone 250-895-1724

s.16(2)(c)

From: Sandberg, Krista
Sent: Wednesday, June 21, 2017 8:20 AM
To: Charbonneau, Michelle
Subject: RE: Notification of Slice Treatments

Its because AAR wasn't effective until July 2015. The rest of those results are in the beginning of the year. Also H2O2 was notified in the first year because we didn't realized it was a registered pesticide.

Krista Sandberg

telephone: 250 286 5835

telephone: 250 286 5835

cellular: [REDACTED]

cellular: [REDACTED]

From: Charbonneau, Michelle
Sent: Tuesday, June 20, 2017 3:03 PM
To: Sandberg, Krista
Subject: RE: Notification of Slice Treatments

Hey Krista,

I hope your week is going well. What was the verdict on the spreadsheet discrepancy for 2015?

Cheers,

Michelle Charbonneau

Michelle.Charbonneau@dfo-mpo.gc.ca

Telephone | Téléphone 250-895-1724

From: Charbonneau, Michelle
Sent: Tuesday, June 13, 2017 1:31 PM
To: Charbonneau, Michelle
Subject: RE: Notification of Slice Treatments

I should have mentioned that I get one return for 2015, also the rest of the results shown were 2015. I haven't compared outputs for other years to cross check. Just noticed this and figured something could explain a big discrepancy like that. Thanks!

Michelle Charbonneau

Michelle.Charbonneau@dfo-mpo.gc.ca

Telephone | Téléphone 250-895-1724

From: Charbonneau, Michelle
Sent: Tuesday, June 13, 2017 1:21 PM
To: 'Sandberg, Krista'
Cc: Manchester, Howie
Subject: RE: Notification of Slice Treatments

Hey Krista,

s.16(2)(c)

A question : We're mining data to get slice and H2O2 treatments for zones 3.3 and 3.4.

If I look at the AAR Notification spreadsheet (from your path below), I get one return.

2015 3.3 Marine Harvest [REDACTED] Althorpe 1300 Emamectin B

If I look at this spreadsheet (X:\AEO\Courtenay\FH\Antibiotic Slice\ Antibiotic and Production Summary ALL COMPANIES.xls), I get way more:

A	B	C	D	E
Company	Facility Reference No	Facility Name	Landfile No	Fish Health Zone
Marine Harvest Canada	1293	Duncan Island, Goletas Channel	1407326	3-4
Marine Harvest Canada	141	Port Elizabeth, Gilford Island	1403104	3-3
Marine Harvest Canada	465	Swanson Island, North side	1404381	3-3
Marine Harvest Canada	467	Midsummer Island, Spring Passage	1404380	3-3
Cermaq	728	Sir Edmund Bay, NE Shore Broughton Inlet	1404179	3-3
Cermaq	819	Cecil Island, Greenway Sound	1405181	3-3
Marine Harvest Canada	820	Wicklow Point, Broughton Island	1405183	3-3
Marine Harvest Canada	821	Glacial Falls, Watson Cove, Tribune Channel	1405180	3-3
Cermaq	1144	Burdwood Group, Raleigh Passage	1406650	3-3
Marine Harvest Canada	1145	Potts Bay, Midsummer Island	1406655	3-3
Marine Harvest Canada	1288	Doyle Island, Gordon Group	1407325	3-4
Marine Harvest Canada	1288	Doyle Island, Gordon Group	1407325	3-4
Marine Harvest Canada	1300	Althorpe, Sunderland Channel	1407426	3-3
Marine Harvest Canada	1300	Althorpe, Sunderland Channel	1407426	3-3
Marine Harvest Canada	1351	Marsh Bay, Stuart Rock N. of P. Hardy	1407749	3-4
Marine Harvest Canada	1586	Doctor Islets, Knight Inlet	1408758	3-3

Can you please explain the difference? What am I missing? I just summarized lice treatments using the AAR sheet for Howie and it's not comprehensive. I don't want to make that mistake again.

Can you please also confirm that I can take the Antibiotic and Production Summary ALL COMPANIES.xls spreadsheet as complete and summarize all of 2014-2017 (submitted to date) for 3.3 and 3.4 Slice and H2O2 use?

Thanks so much!

Michelle Charbonneau

Michelle.Charbonneau@dfo-mpo.gc.ca
Telephone | Téléphone 250-895-1724

s.19(1)

From: Sandberg, Krista

Sent: Thursday, May 25, 2017 12:14 PM

To: Charbonneau, Michelle
Cc: Manchester, Howie
Subject: RE: Notification of Slice Treatments

Hey Michelle, you are absolutely right, I do have a spreadsheet for that! Here's the link:

X:\AEO\Courtenay\FH\Antibiotic Slice\AAR Notification Tracking.xls

This is for all notifications that come in to the AAR inbox. I also cross check it with mortality by category reports to ensure that all deposits have appropriate notifications and vice versa.

Cheers,
Krista.

Krista Sandberg

telephone: 250 286 5835

telephone: 250 286 5835

cellular: [REDACTED]

telephone (mobile): [REDACTED]

From: Charbonneau, Michelle
Sent: Thursday, May 25, 2017 12:03 PM
To: Sandberg, Krista
Cc: Manchester, Howie
Subject: Notification of Slice Treatments

Hey Krista,

Could you please help clear something up?

Where would I go to see the most recent notifications of pending/upcoming/planned Slice treatments?

Sometimes notification comes into the XPAC AQFF FishHealth Inbox, but not consistently. And they aren't fish health events so this isn't the place to look. I can see in the MbyC stuff that Vet Diagnosis column captures SLICE but they are not submitted until the 15th of the next month. This notification comes in consistently within 72hrs of a planned treatment for AAR requirements, does it not? How is that compiled/stored? In an amazing spreadsheet no doubt 😊

Please tell me if this is possible:

I would like to check on notifications of recently completed or proposed and upcoming SLICE treatments before we attend a sea lice audit. Industry is supposed to inform us well in advance when a SLICE treatment is scheduled within a month of our audit. Unfortunately, the notice sometimes doesn't arrive in a timely manner. I'm wondering if you have a tool that can help us out?

Thanks!

MC

s.16(2)(c)

Manchester, Howie

From: Paylor, Adrienne
Sent: July-18-17 8:50 AM
To: Keith, Ian; Manchester, Howie; Waddington, Zac
Subject: FW: a primer on SLICE bioassay needed

Thanks Ian. I thought the last we spoke on this we were fine using the results from Simon's testing? Will Simon be collecting and getting a bioassay done?
Adrienne

From: Keith, Ian
Sent: Monday, July 17, 2017 7:47 PM
To: Paylor, Adrienne
Subject: FW: a primer on SLICE bioassay needed

Hi Adrienne,
I replied to CAHS that I would call in the morning.
Emilie, Simon Jone's technician, will be collecting lice from Esperanza next week and will have her own assistant. Simon says that we would have to arrange our own collection but it is okay with him. Zac has already raised the issue of bioassay EC50 with [REDACTED] Grieg, but not an invitation to collect during harvest.
You can see that the bioassay cost is \$1350. Howie said that Maria or Shawn would be the appropriate DFO person and would stay overnight in Gold River (as will Simon's technicians).
I don't question the EC50 from Grieg (performed in May), but recall that Sonja supported Grieg in repeating the EC50 result last fall, so a repeated bioassay now using DFO-collected lice, is appropriate for credibility.
I don't know how busy your morning is, but will hope you can get back to me.
Thanks
Ian

Dr. Ian Keith DVM
Field Operations Veterinarian - Pacific Region
Fisheries and Oceans Canada | Pêches et Océans Canada
Fisheries Management
Aquaculture Management Division | Gestion de l'aquaculture
Aquaculture Environmental Operations - Fish Health
#103 - 2435 Mansfield Drive
Courtenay, British Columbia V9N 2M2
Telephone | Téléphone: 250-703-0917
Mobile | Portable: [REDACTED]
Fax | Télécopieur: 250-703-0921
Ian.Keith@dfo-mpo.gc.ca

From: [REDACTED]
Sent: Monday, July 17, 2017 1:51 PM
To: Keith, Ian
Cc: [REDACTED]
Subject: RE: a primer on SLICE bioassay needed

Hi Ian

s.16(2)(c)

s.19(1)

I apologize for the delay. We have not had email until a short time ago.

I assume you would like to do an assay on some lice that you are arranging to have collected? We have a protocol that I can send you (our SOP on collection). All the companies here are now doing their own collection after I spent some time with them showing how. Collection off a harvest boat can be a bit messy but as long as rinses are done to keep the water clean, there usually isn't an issue. We will change the water at the lab if the containers look like they need it!

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What area are they being collected from? The bioassay is done the day after arrival and then read 24 hours after exposure

I can do a bioassay next week no problem, although I prefer the lice arrive before Thursday so I don't have to come in on Sat. to read the results.

The cost for an EMB bioassay is: \$1350

We can supply someone to help with collection if that is needed. Cost is [REDACTED]/hour.

Have I answered all your questions? Feel free to phone or email me if you have any concerns or questions I haven't addressed.

[REDACTED]
Cheers,
[REDACTED]

From: Keith, Ian [<mailto:ian.Keith@dfo-mpo.gc.ca>]

Sent: July-15-17 12:20 AM

To: [REDACTED]

Subject: a primer on SLICE bioassay needed

Hi [REDACTED]

During the first half of the of week July 24-28, is there was a possibility of a SLICE bioassay.

There is a harvest opportunity for collection of lice and wondered if

- 1) this was possible
- 2) protocol i.e. how many carboys of water, transfer protocol, numbers, separation on site details etc
- 3) cost estimate

I know this is short notice and it might not be possible but I can't know without asking....

Thanks

Ian Keith

250-703-0917

s.19(1)

Diamond, Maria

From: Manchester, Howie
Sent: 2017-July-18 9:33 AM
To: Diamond, Maria
Cc: Waddington, Zac; Paylor, Adrienne; Keith, Ian
Subject: Lice bio assay

Hi Maria,

See [REDACTED] response below. Please contact [REDACTED] and see if she can send you the protocol and let her know that we will tentatively have lice for her next week, we will have details later today.

Thanks

Howie

Hi Ian

I apologize for the delay. We have not had email until a short time ago.

I assume you would like to do an assay on some lice that you are arranging to have collected? We have a protocol that I can send you (our SOP on collection). All the companies here are now doing their own collection after I spent some time with them showing how. Collection off a harvest boat can be a bit messy but as long as rinses are done to keep the water clean, there usually isn't an issue. We will change the water at the lab if the containers look like they need it!

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Have I answered all your questions? Feel free to phone or email me if you have any concerns or questions I haven't addressed.

[REDACTED]
Cheers,
[REDACTED]

s.19(1)

Diamond, Maria

From: [REDACTED]
Sent: 2018-May-18 12:19 PM
To: Diamond, Maria
Subject: RE: Bioassay SOP
Attachments: SOP 67-v2 Sea Lice Collection and Transport for Sea Lice Bioassay.pdf

Hi Maria
[REDACTED]

Attached is our collection protocol. Feel free to call if you have any questions.
I can supply the collection kit.

Cheers,
[REDACTED]

From: Diamond, Maria [<mailto:Maria.Diamond@dfo-mpo.gc.ca>]
Sent: May 18, 2018 11:32 AM
To: [REDACTED]
Subject: Bioassay SOP

Hey [REDACTED]

[REDACTED] Will see if we actually get the bioassay happening this time around. If you would
please email me the associated SOP that would be great.

[REDACTED]
Maria

Maria Diamond, B.Sc.

Aquatic Science Biologist / Biologiste en sciences aquatiques
Aquaculture Management Division / Gestion de l'aquaculture
Aquaculture Environmental Operations/Opérations environnementales de l'aquaculture
Fisheries and Oceans Canada / Pêches et Océans Canada
#103 - 2435 Mansfield Drive
Courtenay, B.C
Office | Bureau: 250 703 0915
Fax: 250 703 0921



Government
of Canada

Gouvernement
du Canada

Canada

s.19(1)

**Pages 219 to / à 223
are withheld pursuant to sections
sont retenues en vertu des articles**

20(1)(b), 19(1)

**of the Access to Information Act
de la Loi sur l'accès à l'information**

Paylor, Adrienne

From: Paylor, Adrienne
Sent: July-18-17 11:36 AM
To: Calla, Karen
Subject: FW: Report E

FYI.....request to collect bio assay at esperanza

From: Waddington, Zac
Sent: Tuesday, July 18, 2017 9:23 AM
To: Paylor, Adrienne
Subject: RE: Report E

Gotcha. I've been chatting with Howie this morning about that. And I'll get a better idea of how they work and then chat to Sonya for sure. In other news, Ian is very keen to do a bioassay of the lice out at Esperanza. Howie can make it work with the schedule, and has begun to ask around at CAHS and such about the feasibility. Ian's concern is that with sea lice resistance potentially becoming an industry issue, it would be good to show that DFO has been doing independent monitoring of this (one of the first cases). I would agree that it would be best practice, if the funding is possible? I understand there was talk of getting industry to pay? Though I don't want to make them feel that their assay back in May was not valued at all. And thoughts??

Dr. Zac Waddington DVM, B.Env.Sc (Hons)
Lead Veterinarian - Pacific Region
Fisheries and Oceans Canada | Pêches et Océans Canada
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Zac.Waddington@dfo-mpo.gc.ca

From: Paylor, Adrienne
Sent: July-18-17 8:32 AM
To: Waddington, Zac
Subject: FW: Report E

FYI from Sonja.....if you need more insight on these reports you can always call Sonja for ideas on how we could produce them faster.

From: Saksida, Sonja (CFIA/ACIA) [<mailto:Sonja.Saksida@inspection.gc.ca>]
Sent: Tuesday, July 18, 2017 6:36 AM
To: Keith, Ian
Cc: Paylor, Adrienne
Subject: Report E

Hi Ian

Where are the Report E's for 2014- present? Will they be posted soon? They would very useful for me right now in showing BC has been monitoring for SAV and it has not been detected.

Thanks
Sonja

Sonja Saksida BSc, DVM, MSc
Veterinary Program Specialist
Import/Export- Aquatic Section, Animal Health Section
Canadian Food Inspection Agency / Government of Canada
59 Camelot Dr, Ottawa, ON, K1A 0Y9
sonja.saksida@inspection.gc.ca / Tel: 613-773-7390



No information has been removed or severed from this page

Paylor, Adrienne

From: Paylor, Adrienne
Sent: July-18-17 11:40 AM
To: Calla, Karen
Subject: FW: a primer on SLICE bioassay needed

More info on the cost and rational for bioassay from Ian

From: Keith, Ian
Sent: Monday, July 17, 2017 7:47 PM
To: Paylor, Adrienne
Subject: FW: a primer on SLICE bioassay needed

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s.16(2)(c)

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Cc: [REDACTED]
Subject: RE: a primer on SLICE bioassay needed

s.19(1)

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To: [REDACTED]

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Thanks

Ian Keith

250-703-0917

s.19(1)

Paylor, Adrienne

From: Paylor, Adrienne
Sent: July-18-17 11:58 AM
To: Waddington, Zac
Subject: RE: Report E

I just got off my managers call with Karen and she wants to weigh in on this decision so I have sent her some info and just told Ian on the phone that we should await the Directors direction on thisI'll let you know as soon as I hear back from Karen.

From: Waddington, Zac
Sent: Tuesday, July 18, 2017 9:23 AM
To: Paylor, Adrienne
Subject: RE: Report E

Gotcha. I've been chatting with Howie this morning about that. And I'll get a better idea of how they work and then chat to Sonya for sure. In other news, Ian is very keen to do a bioassay of the lice out at Esperanza. Howie can make it work with the schedule, and has begun to ask around at CAHS and such about the feasibility. Ian's concern is that with sea lice resistance potentially becoming an industry issue, it would be good to show that DFO has been doing independent monitoring of this (one of the first cases). I would agree that it would be best practice, if the funding is possible? I understand there was talk of getting industry to pay? Though I don't want to make them feel that their assay back in May was not valued at all. And thoughts??

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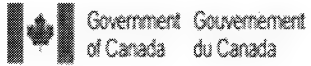
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Paylor, Adrienne

From: Paylor, Adrienne
Sent: July-18-17 2:26 PM
To: Calla, Karen
Subject: RE: Esperanza Bioassay

Thanks for this Karen. Your explanation it is very helpful in facilitating understanding and communication. I have shared with guys and they appreciate the decision/position. I told them if there was further rational we should consider going forward we can continue the discussion in the future. I'll let you know if I hear any more 😊

Thanks,
Adrienne

From: Calla, Karen
Sent: Tuesday, July 18, 2017 1:11 PM
To: Paylor, Adrienne
Subject: RE: Esperanza Bioassay

Hi Adrienne,

I've reviewed the materials provided regarding conducting a bioassay for Slice resistance at Esperanza. At this point I'm not convinced that this is an activity that DFO should undertake. I remain open to hearing other rationales but so far in the materials I have the reasons cited are 1) DFO would use the information to determine if the lice treatment plan proposed by the company is or is not appropriate 2) to inform whether there is Slice resistance in BC and 3) with a team already onsite it would be an incremental cost. I will address each of these reasons with some of my thoughts.

- 1) To respond to a proposed Slice treatment: If Grieg proposes to use Slice in their treatment plan for Esperanza or Steamer in the future I would expect that DFO would require Grieg to undertake a bioassay to confirm Slice would be effective before we would support their plan. DFO would take issue with accepting the potential negative impacts of a chemical treatment when the benefits are highly questionable (i.e. resistance still there). This would keep the responsibility and costs for the bioassay with the company. I would think that Grieg would be using hydrogen peroxide to treat in this area now that they have invested in the infrastructure for it? Or am I missing something here?
- 2) Is there Slice resistance in BC: to really answer this question a much broader sampling and testing program would need to be undertaken. We know already that resistance has been encountered in this location. I'm fuzzy on why we need to confirm it is still there... A full sampling and testing program would be a significant new activity with associated costs. To do that I would need to confirm if this is in our mandate with my managers and whether this is more a scientific evaluation or a management activity. If this is what is being proposed then we will need much more detail on the why, how, who, etc. to get it started.
- 3) Incremental cost: I appreciate that there would be efficiencies to testing while we have a team out there but it is only efficient if we have a clear understanding of how we would use the findings in our decision making and we are confident this is an activity that AMD should be doing.

I am open to hearing other views, contrary information or other reasons why we might engage in this activity.

Thanks, Karen

From: Paylor, Adrienne
Sent: Tuesday, July 18, 2017 12:39 PM
To: Calla, Karen <Karen.Calla@dfo-mpo.gc.ca>
Subject: FW: Esperanza Bioassay

I told the guys to stand down on this until we get back to them (hopefully today). What this bioassay would give us is independent affirmation that Slice can once again be effective in this area as a proposed treatment plan. Otherwise the AEO vet's would advise industry vet's that they have to submit an alternative or more appropriate treatment plan that we feel would be more effective at protecting wild fish.

From: Manchester, Howie
Sent: Tuesday, July 18, 2017 9:47 AM
To: Stenhouse, Shawn
Cc: Diamond, Maria; Charbonneau, Michelle; Waddington, Zac; Keith, Ian; Paylor, Adrienne
Subject: Esperanza Bioassay

Hey Team,

I just wanted to give you the heads up that Ian needs Shawn and Maria to travel up to Esperanza next week (can't do it this week due to no harvest at this site) to collect sea lice for a Bioassay. The bioassay will be performed by CAHS, Maria and I will make the arrangements with Grieg and CAHS. Zac may be available next week if needed to help with the collection, I think it's a good idea for him to attend and help so I will try to include him on the trip. We can delay the trip to Venture on Wednesday, July 26 until later in the quarter , possibly the same week as Okisollo (week of August 4th) but we won't tell the company we are cancelling until we are sure this bioassay trip is going forward.

I would ask for you to leave the OB in Goldriver but with the latch not working on the starboard side window that's not a good idea so will most likely will have to tow back and forth.

I'll work on the details. More to come.

Thanks

Howie

Paylor, Adrienne

From: Paylor, Adrienne
Sent: July-19-17 10:34 AM
To: Calla, Karen
Subject: RE: Esperanza Bioassay

Yes indeed [REDACTED]

From: Calla, Karen
Sent: Wednesday, July 19, 2017 10:10 AM
To: Paylor, Adrienne
Subject: RE: Esperanza Bioassay

[REDACTED]

From: Paylor, Adrienne
Sent: Wednesday, July 19, 2017 10:02 AM
To: Calla, Karen <Karen.Calla@dfo-mpo.gc.ca>
Subject: FW: Esperanza Bioassay

Ian always has something interesting to add 😊 [REDACTED]

From: Keith, Ian
Sent: Wednesday, July 19, 2017 9:48 AM
To: Paylor, Adrienne; Waddington, Zac; Manchester, Howie
Subject: RE: Esperanza Bioassay

Hi Adrienne,

Further to our call yesterday, where the only rationale for our independent bioassay result from Esperanza would be chain of custody, i.e. the follow up from Grieg's May bioassay:

Zac and Howie and I focussed on Karen's question, "Am I missing something?"

We feel that the lice population has been sufficiently sampled i.e. Ben Koop, the geneticist at UVictoria has samples of the lice from last fall and assumedly, this spring – I know that he has sample from last fall and can confirm that he has lice from this spring, if important.

We assume that the bioassay information is sufficient i.e. CAHS is credible. I will check with Simon to see if follow up bioassays are necessary for robust estimation of EC50s

[REDACTED]

Thanks
Ian

s.19(1)
s.21(1)(a)
s.21(1)(b)

From: Paylor, Adrienne
Sent: July-18-17 1:43 PM
To: Waddington, Zac; Keith, Ian; Manchester, Howie
Subject: FW: Esperanza Bioassay

Hi guys,

Karen is not convinced this is something we should be paying for. If there is some rationale that I have missed providing her please let me know and the discussion can continue.

Thx Adrienne

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Sent: Tuesday, July 18, 2017 12:39 PM
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Subject: FW: Esperanza Bioassay

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I'll work on the details. More to come.

Thanks

Howie

Manchester, Howie

From: Paylor, Adrienne
Sent: July-20-17 3:27 PM
To: Keith, Ian; Waddington, Zac; Manchester, Howie
Subject: RE: DFO Esperanza lice collection

It is my understanding that the province regulates discharge from processing plants so I'm not sure what our C&P would be able to offer here. Is there something in our CoL that allows us to charge someone for Slice resistant lice? I see that moving the lice to other areas is a concern if they are not already being moved there by/on wild fish? Bernie is coordinating the working group looking at how we can strengthen and clarify our COL around sea lice so perhaps we should bring this issue up there for discussion at our next meeting.

Adrienne

From: Keith, Ian
Sent: Thursday, July 20, 2017 11:19 AM
To: Waddington, Zac; Manchester, Howie
Cc: Paylor, Adrienne
Subject: RE: DFO Esperanza lice collection

I have to focus on finishing Report E but if you are willing to pursue this Zac, we think this is important. The Marine Harvest processing plant in Port Hardy has effluent clarification and disinfection and CFIA knows this but to my understanding CFIA has not set standards for plants for dealing with effluent.

It is protocol and respectful to first talk with Joe, the C&P lead in Campbell River; I haven't done more than meeting Joe but I would call his predecessor and he would assign an officer, once informed of the situation. Mike Ballard would be the one I would want to consult, if okay with Joe. If able to speak with him - he isn't working Finfish at the moment and is on assignment in Prince George - he is the one I have worked with in the past so know that he knows the detail of the HMP and licence conditions. (I haven't worked any cases up with others in C&P.)

Howie suggested checking for viability of lice and egg strings from lice on the fish on the processing line, and with this approach we might be able to sample through Grieg, not requiring C&P. However, CAHS, sampled from the effluent pipe from a plant and found that the lice were viable, and she hatched eggs and followed these through the napuli stages. The advantage of her approach is that eggs from any point in the process would be captured. The disadvantage is that since Browns Bay plant may already have processed some wild salmon, and the argument could be made that eggs came from other sources. If there were viable lice on the line, and viable lice in the discharge, then all we would have to demonstrate is 48 or 72 hour viability, whatever is the standard used for bioassay viability. It would also be possible to compare sequences for confirmation that lice from fish and lice in the discharge were the same source.

Of course, eggs from the plant are the greater risk, and this is a potential concentrated point source of lice for returning adults. (I assume that Seymour Narrows is too fast for juveniles but I don't know this.) Regardless, the resistant lice should not move from west coast to east coast but demonstrating viability of eggs means hatching and Simon Jones is busy right now. However, Shannon Balfry at the West Vancouver DFO lab is currently hatching lice in her system, so is a potential resource for us. CAHS doesn't have an aquarium like Nanaimo or West Van, so relies on changes of water and airstones, the same as we in Courtenay would do. (Maria has done this sort of thing at Atlantic Vet College, but we would want to farm out the work if possible.)

In the discharge would be lice and or eggs from any source associated with the process, from the ice slurry in the hold of the harvest vessel, or 1 tonne Xactics totes on the flat bed, the washings after from those empty holds, or the washing from the plant floors.

When Grieg changed processing plants without changing this in their licence, their SOPs would change so we can't be sure how the harvest vessel is dealing with the hold water from Esperanza Inlet when transferring the harvested fish

into totes at Muchalat Channel. I have raised the detail that the changing of the processing plant may require amendments to the Grieg licences and therefore the opportunity to make changes in Grieg's licence conditions,

Thanks for this.

Ian

Dr. Ian Keith DVM
Field Operations Veterinarian - Pacific Region
Fisheries and Oceans Canada | Pêches et Océans Canada
Fisheries Management
Aquaculture Management Division | Gestion de l'aquaculture
Aquaculture Environmental Operations - Fish Health
#103 - 2435 Mansfield Drive
Courtenay, British Columbia V9N 2M2
Telephone | Téléphone: 250-703-0917
Mobile | Portable: [REDACTED]
Fax | Télécopieur: 250-703-0921
Ian.Keith@dfo-mpo.gc.ca

From: Waddington, Zac
Sent: Thursday, July 20, 2017 7:34 AM
To: Manchester, Howie; Keith, Ian
Subject: RE: DFO Esperanza lice collection

I have no issue with you responding Howie. Have we heard anything about collection at Brown's Bay?

Dr. Zac Waddington DVM, B.Env.Sc (Hons)
Lead Veterinarian - Pacific Region
Fisheries and Oceans Canada | Pêches et Océans Canada
Fisheries Management
Aquaculture Management Division | Gestion de l'aquaculture
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Zac.Waddington@dfo-mpo.gc.ca

s.16(2)(c)

s.19(1)

s.21(1)(b)

From: Manchester, Howie
Sent: July-19-17 5:43 PM
To: Waddington, Zac; Keith, Ian
Subject: FW: DFO Esperanza lice collection

s.23

Would either of you like to respond, let me know, I have not problem responding to this email if your ok with me doing so.

Howie

From: [REDACTED]
Sent: Wednesday, July 19, 2017 4:46 PM
To: Manchester, Howie

Cc: Waddington, Zac; Diamond, Maria
Subject: RE: DFO Esperanza lice collection

Hi Howie,

What's the thinking behind the bioassay? How will the information be used? I've supplied the bioassay results completed in May. Does this info meet your needs?

Cheers,

From: Manchester, Howie [mailto:Howie.Manchester@dfo-mpo.gc.ca]
Sent: Tuesday, July 18, 2017 10:10 AM
To: [REDACTED]
Cc: Waddington, Zac <Zac.Waddington@dfo-mpo.gc.ca>; Diamond, Maria <Maria.Diamond@dfo-mpo.gc.ca>
Subject: DFO Esperanza lice collection

Hi [REDACTED]

We were hoping we could arrange a visit next week to Grieg's Esperanza farm site for the purpose of collecting some motile *L. salmonis* lice in order to conduct a bioassay. At this point I'm collecting information and putting together logistics on how we can accomplish the collection. Can you please answer the following questions:

Can you please let me know what days you are harvesting next week?
If you are harvesting, what time is the scheduled start of harvest and for how long do they harvest during a day?
Is there room on the vessel for one or two DFO staff to collect lice during harvest?
Does the collection occur post stunning?

Any other information that would help us with the collection would be appreciated.

Zac has informed me that in speaking with you that a harvest was planned for July 25th, this day would be ideal for us but he has also informed me that there are other DFO staff collecting lice (from Simon Jones group) , will their attendance impede any collection we may want to carry out?

Sorry for the late notice. Please call me if you want to discuss.

Mobile: [REDACTED]
Work: 250 703 0916

Thanks

Howie

s.16(2)(c)
s.19(1)

Manchester, Howie

From: [REDACTED]
Sent: July-21-17 8:56 AM
To: Waddington, Zac
Cc: Diamond, Maria; Manchester, Howie; Keith, Ian
Subject: RE: DFO Esperanza lice collection

Thanks Zac. [REDACTED]

Cheers,
[REDACTED]

From: Waddington, Zac [mailto:Zac.Waddington@dfo-mpo.gc.ca]
Sent: Thursday, July 20, 2017 3:59 PM
To: [REDACTED]
Cc: Diamond, Maria <Maria.Diamond@dfo-mpo.gc.ca>; Manchester, Howie <Howie.Manchester@dfo-mpo.gc.ca>; Keith, Ian <Ian.Keith@dfo-mpo.gc.ca>
Subject: RE: DFO Esperanza lice collection

Thanks so much for being willing to share your bioassay results with us. Unfortunately we weren't able to get the funding in place to be able to get ourselves out to Epseranza to get any lice of our own. Our rationale for wanting to do that in the first place was just to try and replicate these results, and ensure that we were doing our due diligence, given the history of resistance in the area. So with the lack of time and funding, your results will at least allow us to be able to say that we were aware of the status of sea lice susceptibility/resistance at a snap shot in time during the harvest from your site. Thanks again for being willing to share your info with us. Very sorry about the run around, in the future I'll try to get funding in place for anything out of the ordinary like this, prior to bothering you with a pile of questions. Hope you have a good weekend,

Dr. Zac Waddington DVM, B.Env.Sc (Hons)
Lead Veterinarian - Pacific Region
Fisheries and Oceans Canada | Pêches et Océans Canada
Fisheries Management
Aquaculture Management Division | Gestion de l'aquaculture
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Fax | Télécopieur: 250-703-0921
Zac.Waddington@dfo-mpo.gc.ca

From: [REDACTED]
Sent: July-19-17 4:46 PM
To: Manchester, Howie
Cc: Waddington, Zac; Diamond, Maria
Subject: RE: DFO Esperanza lice collection

s.19(1)

Hi Howie,

What's the thinking behind the bioassay? How will the information be used? I've supplied the bioassay results completed in May. Does this info meet your needs?

Cheers,

From: Manchester, Howie [<mailto:Howie.Manchester@dfo-mpo.gc.ca>]

Sent: Tuesday, July 18, 2017 10:10 AM

To: [REDACTED]

Cc: Waddington, Zac <Zac.Waddington@dfo-mpo.gc.ca>; Diamond, Maria <Maria.Diamond@dfo-mpo.gc.ca>

Subject: DFO Esperanza lice collection

Hi [REDACTED]

We were hoping we could arrange a visit next week to Grieg's Esperanza farm site for the purpose of collecting some motile *L. salmonis* lice in order to conduct a bioassay. At this point I'm collecting information and putting together logistics on how we can accomplish the collection. Can you please answer the following questions:

Can you please let me know what days you are harvesting next week?

If you are harvesting, what time is the scheduled start of harvest and for how long do they harvest during a day?

Is there room on the vessel for one or two DFO staff to collect lice during harvest?

Does the collection occur post stunning?

Any other information that would help us with the collection would be appreciated.

Zac has informed me that in speaking with you that a harvest was planned for July 25th, this day would be ideal for us but he has also informed me that there are other DFO staff collecting lice (from Simon Jones group) , will their attendance impede any collection we may want to carry out?

Sorry for the late notice. Please call me if you want to discuss.

Mobile: [REDACTED]

Work: 250 703 0916

Thanks

Howie

s.16(2)(c)

s.19(1)

Jones, Simon

From: Taylor, Nathan
Sent: Wednesday, August 23, 2017 9:30 AM
To: Jones, Simon
Subject: FW: Input on QP Note Regarding Sea Lice - URGENT
Attachments: ML_AQUA_BroughtonLicePaper (2).docx

Importance: High

Follow Up Flag: Follow up
Flag Status: Flagged

Hi Simon – are you aware of any more recent media lines than the attached?

From: Merritt, Olivia
Sent: Wednesday, August 23, 2017 7:30 AM
To: Taylor, Nathan
Cc: Lavigne, Joliane
Subject: FW: Input on QP Note Regarding Sea Lice - URGENT
Importance: High

Hi Nathan,

March Klaver indicated to me that you may be able to help out with the review of a few QP note lines regarding sea lice (see the email below, in particular the blue highlighted bullet). Would you be able to take a look at this today? By COB this afternoon would be much appreciated, if possible. Also, would you happen to have any current background lines on the sea lice issue? We are lacking a background section for this issue in the Aquaculture QP note, and March provided with the attached Media Lines from August 2016 to pull from... but any guidance you could provide on this would be much appreciated as well.

Please give me a call if I can help clarify.

Thanks!

Olivia Merritt
Policy Analyst / Analyste des politiques
Aquaculture Policy / Politiques de l'aquaculture
Aquatic Ecosystems Sector / Secteur des écosystèmes aquatiques
Fisheries and Ocean Canada / Pêches et Océans Canada
200 Kent Street, Ottawa, Ontario, K1A 0E6
Telephone: (613) 617-1019
Email: Olivia.merritt@dfo-mpo.gc.ca

From: Klaver, March
Sent: 2017–August-22 7:33 PM
To: Kenyon, Robyn; Andres, Byron; Rainer, Michelle; Merritt, Olivia
Subject: RE: Input on QP Note Regarding Sea Lice - URGENT

Best available copy

Hi Olivia,

Without our Fish Health staff able to comment I would like to revise to:

- Fisheries and Oceans Canada receives ongoing sea lice monitoring data from the aquaculture industry as required by the conditions of licence for marine finfish aquaculture sites in BC.
- Fisheries and Oceans Canada operates an audit program to validate industry generated data. This information is available online.
<http://open.canada.ca/data/en/dataset/5cfd93bd-b3ee-4bob-8816-33d388f6811d>
- Recently reported data from the Broughton Archipelago do not indicate a significant increase in sea lice which could have led to a significant infection of wild juvenile salmon.
- The Department has an ongoing, active research program to understand the interactions between wild salmon and salmon farming, including studies on sea lice. Confirm with Nathan Taylor (Pacific Region Science) or omit
- The regular audit and monitoring program helps to inform decisions on the sustainable management of the salmon farming sector.

Regards,

March

From: Klaver, March
Sent: Tuesday, August 22, 2017 8:34 AM
To: Andres, Byron
Cc: Waddington, Zac
Subject: FW: Input on QP Note Regarding Sea Lice - URGENT

Hi Byron

Kerra didn't reply yesterday so you will need to complete by noon today so I can review and send back to Olivia.

Thanks

March Klaver

From: Merritt, Olivia
Sent: August-21-17 1:27 PM
To: Klaver, March; Shaw, Kerra
Cc: Lavigne, Joliane
Subject: RE: Input on QP Note Regarding Sea Lice

Hi Kerra,

Sorry to add on some work here! But would you be able to provide a few bullets of background as well (see page five of the attached QP as an example)? I just realized we have no background section for sea lice, and as it is required, we will need to furnish some...

Please give me a call if you have any questions!

Thanks,

Olivia

From: Klaver, March
Sent: 2017–August-21 3:40 PM
To: Shaw, Kerra
Cc: Merritt, Olivia; Lavigne, Joliane
Subject: FW: Input on QP Note Regarding Sea Lice

Hi Kerra
Can you please edit as necessary and return to me today, thanks.

Regards

March Klaver

From: Merritt, Olivia
Sent: August-21-17 12:19 PM
To: Klaver, March
Cc: Lavigne, Joliane
Subject: Input on QP Note Regarding Sea Lice

Hi March,

I hope you're having a good start to your week. Here in NCR, we've been sent an urgent request for QP notes, including an update on the sea lice situation. Would you be able to look at the text below, and respond with comments/edits by COB tomorrow (August 22, 2017). Please let me know if this would be possible.

If pressed on sea lice in BC (Broughton Archipelago):

- Fisheries and Oceans Canada's is continuously monitoring sea lice situation as part of its conditions of licence for marine finfish aquaculture in BC.
- Current monitoring reports from BC do not indicate a significant increase in sea lice in the Broughton Archipelago which could have led to a significant infection of wild juvenile salmon.
- The Department is investigating the reported situation.
- The Department has an ongoing, active research program to understand the interactions between wild salmon and salmon farming, including studies on sea lice.
- These DFO studies and other studies help to inform decisions on the sustainable management of the salmon farming sector.

Thank you,

Olivia Merritt

Policy Analyst / Analyste des politiques

Aquaculture Policy / Politiques de l'aquaculture

Aquatic Ecosystems Sector / Secteur des écosystèmes aquatiques

Fisheries and Ocean Canada / Pêches et Océans Canada

200 Kent Street, Ottawa, Ontario, K1A 0E6

Telephone: (613) 617-1019

Email: Olivia.merritt@dfo-mpo.gc.ca

No information has been removed or severed from this page

**Pages 244 to / à 245
are duplicates of
sont des duplicatas des
pages 10 to / à 11**

Manchester, Howie

From: Waddington, Zac
Sent: September-08-17 3:51 PM
To: [REDACTED]
Cc: [REDACTED] Manchester, Howie
Subject: RE: *Confidential: Re: RE: Re: Rant Point Mortality Events

Thanks very much for that confirmation. That is indeed what we were suspecting, just wanted to hear it from the horses mouth so to speak. Thanks very much for your transparency, [REDACTED]

Zac

From: [REDACTED]
Sent: Friday, September 08, 2017 3:03 PM
To: [REDACTED]
Cc: Waddington, Zac
Subject: *Confidential: Re: RE: Re: Rant Point Mortality Events

Hi - to answer your two questions. 1) The treatment at Millar was successful (91.2% change from 2wks pre-treatment to 5wks post-treatment - factoring in the lice development in the two weeks pre the rate would be much higher) and we're now treating what is likely largely a re-infection from adult lousy wild salmon. It's a general trend and every area will have different pressures and timing and other factors like s- Dixon for example very close to Millar doesn't seem to be as effected for example likely because the chinook and coho runs that are lousy in the summer tend to migrate very close to Millar which is across from their river and likely lies on their migratory route. Okisollo on this side starts getting massive lice loads more from pink and then chum which run aug / sep for example. 2) If I could definitively prove the cause of environmental damage every time I would be long retired to a remote location somewhere in the caribbean. But seriously Chrysochromulina alone has 55 species alone of which not much is known with regards to species toxicity, is < 10um so very difficult to identify, and is not routinely identified to species [REDACTED] The diagnosis is based on absence of other known harmful algae, clinical signs which in this case are almost always acute signs of gill hemolysis followed by necrosis, and presence of the species at several sites in the Tofino area that were confirmed both internally / externally. Once you've seen the clinical signs it's pretty obvious it's plankton related - we're working on a number of different fronts to both confirm the exact species involved as well as the mechanism of action.

s.19(1)

Lice samples

Date	Number of detailed samples	Number of fish examined	Average Lep. female + movable	Average Lep. Movable	Average Lep. Juveniles	Average Lep. Adult female	Average Elongated stages
05/09/2017	1	30	4.07	1.70	4.27	2.37	
03/09/2017	1	30	8.20	4.10	6.57	4.10	
02/09/2017	1	30	6.70	3.77	5.13	2.93	
20/08/2017	1	30	3.13	2.03	4.27	1.10	
17/08/2017	2	60	3.20	2.08	0.90	1.12	
05/08/2017	1	30	1.53	1.30	6.93	0.23	
04/08/2017	2	60	0.78	0.63	2.10	0.15	
19/07/2017	1	30	1.03	0.60	0.00	0.43	
18/07/2017	1	30	0.77	0.30	0.00	0.47	
17/07/2017	1	30	0.70	0.40	0.00	0.30	
05/07/2017	1	30	0.77	0.53	0.00	0.23	
02/07/2017	1	30	0.33	0.13	0.00	0.20	
01/07/2017	1	30	0.47	0.23	0.00	0.23	
20/05/2017	1	30	5.30	4.17	0.40	1.13	
18/05/2017	1	31	5.42	4.90	0.90	0.52	
17/05/2017	1	30	5.00	4.47	0.90	0.53	
04/05/2017	1	30	7.77	7.47	1.57	0.30	
03/05/2017	1	30	2.83	2.60	0.23	0.23	
02/05/2017	1	30	3.00	2.67	0.77	0.33	
18/04/2017	1	30	0.53	0.50	3.43	0.03	
16/04/2017	2	60	0.70	0.70	2.30	0.00	
02/04/2017	3	90	0.53	0.47	0.07	0.07	

CERMAQ

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From: [REDACTED]
To: "Waddington, Zac" <Zac.Waddington@dfo-mpo.gc.ca>
Cc: [REDACTED]
Date: 08/09/2017 09:21 AM
Subject: *Confidential: RE: Re: Rant Point Mortality Events

s.19(1)

Hi Zac,

My apologies for the delayed response.

The average weight I have in the report is based on each pens average wt so it is likely the number you took at the site is the whole farm average. There is also the possibility that if Wt sampling occurred within days of the audit this would then slightly change the average wt and growth rate settings in the Fishtalk program, but this should be fairly small as the numbers are locked at the end of each week.

I am forwarding this email [REDACTED] who will be better able to answer your 2 more specific Fish Health questions around the mortality levels at Rant and the Repeat Slice treatment.

Thanks

[REDACTED]
From: "Waddington, Zac" <Zac.Waddington@dfo-mpo.gc.ca>
To: [REDACTED]
Date: 08/09/2017 08:20 AM
Subject: RE: *Confidential: Re: Rant Point Mortality Events

Have you had a chance to look into those questions below by any chance? I would be quite happy to get this sorted prior to the weekend. Thanks a bunch,

Zac

From: Waddington, Zac
Sent: Wednesday, September 06, 2017 5:15 PM
To: [REDACTED]
Subject: RE: *Confidential: Re: Rant Point Mortality Events

Thanks very much for that information. The reason for the discrepancy between your calculations and ours is that the average weight of fish that we used for our fish was consistently higher. For instance, the farm average weight given to us on the day of the audit (Aug 28/17) was 707.6 g. However, your stated "mortality average weight" is only 692.3g. So obviously the mortality average weight is being generated in a different fashion from the farm average weight. Is it due to different average weights in a given pen and then the corresponding mortalities from that pen?

Also, during this audit period in Clayquot region, numerous sites reported having issues with chrysochromulina sp.; however, at Rant point the manager stated that there had been no plankton issues in the past two weeks to necessity stopping feeding. Despite quite elevated throughout that time. Have your fish health team confirmed that chryso. Is indeed the culprit behind this elevated mortality?

One last question, it was noted during the audit of Miller Channel that SLICE was used in June 2-8, and has been ordered again for being above threshold. Has any testing been done to ensure that this current lice burden is not due to a treatment failure from the June treatment? Are you doing, or considering, a bioassay of the lice prior to the pending treatment?
Thanks very much for your help,

Zac

s.19(1)

From: [REDACTED]
Sent: Wednesday, September 06, 2017 3:42 PM

To: Waddington, Zac
Cc: [REDACTED]
Subject: *Confidential: Re: Rant Point Mortality Events

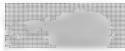
Hello Zac,

Please find attached for your reference a snap shot from Farm Control and an exported excel spreadsheet of our mortality at Rant Point from July 23 - Aug31.

I have reviewed the dates you provided and the remainder of the period and although we are close, we have not hit the reporting trigger, yet. As you can see there is a spike in numbers every 2 - 3 days as we had increased the number of dive days in addition to the daily mort pumping to ensure that we did not miss a spike in mortality that would have tipped us over the threshold.

Hopefully this clears up why we have not submitted a notification at this time.

Thanks,



CERMAQ

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s.19(1)

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From: "Waddington, Zac" <Zac.Waddington@dfo-mpo.gc.ca>
To: [REDACTED]
Date: 06/09/2017 10:06 AM
Subject: Rant Point Mortality Events

As per our conversation.

We identified a one day mortality event on July 26th with 7, 792 fish dead at an average weight of 532g. Equaling 4145 kg.

We also identified a 5 day mortality event from August 21-Aug 25th with a total of 15006 fish dead with an estimated average weight of 700g (we have the farm average weight records as 705g on the 26th). Equaling 10504kg.

If you confirm that these numbers and calculations are indeed correct, please submit two urgent notifications for the respective

mortality events and we can proceed from there.



Thanks,

Dr. Zac Waddington DVM, B.Env.Sc (Hons)
Lead Veterinarian - Pacific Region
Fisheries and Oceans Canada | Pêches et Océans Canada
Aquaculture Environmental Operations - Fish Health
Courtenay, British Columbia V9N 2M2
Telephone | Téléphone: 250-703-0902
Fax | Télécopieur: 250-703-0921
Zac.Waddington@dfo-mpo.gc.ca

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Any unauthorised use, dissemination of the information or copying of this message is prohibited.

s.19(1)

Manchester, Howie

From: Manchester, Howie
Sent: September-11-17 11:21 AM
To: Waddington, Zac
Subject: SLICE and Antibiotic spreadsheets

[X:\AEO\Courtenay\FH\Antibiotic Slice\Antibiotic and Production Summary ALL COMPANIES.xls](#)

[X:\AEO\Courtenay\FH\Antibiotic Slice\AAR Notification Tracking.xls](#)

Here are the links to the Antibiotic and Slice usage spreadsheets. These are managed by Krista. We can also see Slice and Antibiotic usage on the quarterly Mortality by Category spreadsheets.

Howie

Waddington, Zac

From: Keith, Ian
Sent: October-04-17 11:15 PM
To: Waddington, Zac; Paylor, Adrienne
Subject: SOPs

Hi there,

I know we are all running flat out so don't be upset by more pressing matters.

(No one but Howie and Maria understand the two seasons in aquaculture, broodstock screening season and the rest of the year.)

I prepared the emails last month to give the labs and the vets plenty of heads-up time for broodstock screening. It is now too close for comfort and I will talk to the vets directly again. (I have spoken to both of them.) I am prepared to send the SOP letters unless the meetings that were supposed to occur with experts is counter to the SOPs. I would want these letters sent ahead of your FIAP meeting.

I will be talking with those experts I have yet to speak with regarding SLICE resistance while I get your feedback Claire. I would like to send this email ahead of your FIAP meeting too.

Wow. I don't think this is what the Eagles meant by life in the fast lane.

Thanks

Ian

Waddington, Zac

From: Keith, Ian
Sent: October-04-17 1:54 PM
To: Paylor, Adrienne
Cc: Waddington, Zac; Manchester, Howie
Subject: letter for Claire's review
Attachments: Oct 2017 letter to veterinarian_6.doc

Importance: High

Hi Adirenne,

While you were meeting with Claire I was to get this letter to you, hence the exclamation mark.

I appreciate criticism too.

Ian

Dr. Ian Keith DVM
Field Operations Veterinarian - Pacific Region
Fisheries and Oceans Canada | Pêches et Océans Canada
Fisheries Management
Aquaculture Management Division | Gestion de l'aquaculture
Aquaculture Environmental Operations - Fish Health
#103 - 2435 Mansfield Drive
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Mobile | Portable: [REDACTED]
Fax | Télécopieur: 250-703-0921
Ian.Keith@dfo-mpo.gc.ca

s.16(2)(c)

[REDACTED]

Thank you for the 25 September call with the explanation for the mortality with the transfer from Concepcion and the bioassay results from Atrevida.

Thanks too for sharing your comments on sea lice management in Nootka. This letter is my response to your proposal.

You said that you plan to "peroxide all Nootka." We knew that you would be using peroxide at Gore, as well as freshwater and the Hydrolyser® as these were the sea lice management modalities described during the call with [REDACTED] others (conference call September 7) and were key to your argument for the transfer permit.

In Ms Calla's follow-up letter to the call (September 8, DFO file 2017-502-00189) Health Management SOPs were requested prior to the ITC licence submission [REDACTED] said they would be submitted October 15. This letter pertains to the SOPs for lice management as described [REDACTED] during the meeting. [REDACTED] explained how the circular cages would have a dividing net and the treated fish would enter the same cage that they came from but separated from the untreated by the net. This was specifically for answering questions about peroxide treatment. [REDACTED] didn't go into much detail about the Hydrolyser®-equipped barge as the mechanical sea lice management tool but it was implied that it too would use the divided cage. He explained the limitations of your leased well boat for freshwater treatment but described options baths. So the basics of the SOPs were given during the meeting and Ms Calla's letter and this letter are reminding you of expectations for the October 15 submission.

All from DFO on the September 7 conference call were aware of the SLICE® resistance at Esperanza/Steamer in September 2016 and Ms Calla, if not all, was aware of the dramatically high EC₅₀ compared with data from other areas within the fish health zone. DFO is also aware of repeated failed response to SLICE in Nootka, confirmed by the Grieg veterinarian in Spring 2015 and apparent from the submitted data in 2016. We have data back to 2008 on failure of lice management by SLICE in the area and bioassays have failed to predict SLICE® performance (reference to Steamer bioassay 2014). Ms Calla is aware that SLICE® has a drug identifier number (DIN) and so prescription for its use is in the purview of the veterinarian. It is therefore in the purview of the DFO regulatory veterinarian to not permit use of emamectin benzoate in Esperanza Inlet or Muchalat Channel until further notice, based on the literature, the history of low if any efficacy in Esperanza inlet and Muchalat Channel, and absence of Grieg research to challenge this interpretation of the data.

I look forward to your revised Health Management SOP October 15.

Regards,

Ian

s.19(1)

Paylor, Adrienne

From: Paylor, Adrienne
Sent: October-05-17 5:28 PM
To: Keith, Ian
Subject: Fw: letter re: SLICE to Grieg
Attachments: oct Grieg SLICE treatments Option 2.docx

Ian I know I lost some of the detail in your draft so please let me know what needs to be added back in and if you feel the letter should come directly from you

A

Sent from my BlackBerry 10 smartphone on the Rogers network.

From: Paylor, Adrienne <Adrienne.Paylor@dfp-mpo.gc.ca>
Sent: Thursday, October 5, 2017 4:54 PM
To: Jackson, Corey
Cc: Keith, Ian; Knight, Joe; Waddington, Zac
Subject: RE: letter re: SLICE to Grieg

Sorry Option 2 letter didn't attach correctly so sending here

From: Paylor, Adrienne
Sent: Thursday, October 05, 2017 4:38 PM
To: Jackson, Corey
Cc: Keith, Ian; Knight, Joe; Waddington, Zac
Subject: letter re: SLICE to Grieg

Hi Corey

As per our phone conversation and the message I just left you, attached are 2 draft letters to Grieg indicating our concern with Slice use in Nootka. I've also attached the past correspondence that I have on file regarding this issue that has already been sent to Grieg for context and continuity. Option 1 is veterinarian to veterinarian correspondence. [REDACTED]

[REDACTED] So option 2 is director to CEO correspondence [REDACTED]
[REDACTED] I am cc'ing Joe Knight here to keep him in the loop and ensure it captures the conversation today but we'll clearly need to discuss this further as a group.

If we decide to send one of these letters, it would need to go out before October 15 which is the deadline referred to for SOP submission in our CoL.

Once you have had a chance to review we can set up a time to discuss.

Thanks,
Adrienne



Fisheries and Oceans
Canada

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Suite 200 – 401 Burrard Street
Vancouver, British Columbia
V6C 3S4

Pêches et Océans
Canada

Région du Pacifique
Pièce 200 – 401 rue Burrard
Vancouver (C-B.)
V6C 3S4

Our file Notre référence
2017-XXX-XXXXX

October 5, 2017

Grieg Seafood

Attn: [REDACTED]

106 - 1180 Ironwood Street
Campbell River, BC, V9W 5P7

RE: PROPOSED SEA LICE TREATMENTS IN NOOTKA

This letter is in response to a recent phone conversation on September 25, 2017 between Ian Keith [REDACTED] and concerns regarding the use and application of SLICE© treatments in Nootka Sound and Esperanza Inlet. On September 7, 2017 DFO staff participated in a conference call with Grieg management and fish health staff to discuss a number of concerns regarding the stocking of the Gore Island site, which included general fish health management issues at that location and more broadly in Nootka Sound. During this call Grieg communicated that bath treatments of hydrogen peroxide in well boats were planned for sea lice treatment in Nootka Sound, along with options to employ freshwater and the Hydrolyser®.


On September 8, 2017 DFO followed up with written concerns and requested a detailed response from Grieg to identify mitigation for the described risks. In particular, items 3 and 4 spoke to the proper dosage of fish for in-feed treatments and the response to a louse outbreak. Grieg's written response on September 11, 2017, again identified alternative lice treatments, but indicated that complete updated Standard Operating Procedures (SOPs) would be submitted by October 15, 2017 in order to maintain compliance with Condition of Licence 4.2. Based on the proposal discussed and the commitment of detailed written SOPs on or before October 15, DFO issued Grieg a permit to stock the Gore Island site.

However, during the phone conversation of September 25, it came to our attention that you are now considering the use of SLICE in Nootka Sound. I would like to reiterate that there is growing evidence and concern of a failed response to SLICE in Nootka Sound and Esperanza Inlet and it is our veterinarians' professional opinion that it is longer prudent to use this drug in these areas at this time. You have shared bioassay and treatment results that support this position. DFO issued the transfer permit to Gore Island with the understanding that alternate treatments and not SLICE would be used, and we expect to see that reflected in the October 15 SOP submission for Gore Island, but also

s.19(1)

Canada

for all farms in Nootka Sound and Esperanza Inlet. Please note that we will reject any SOPs that do not properly address this concern.



Please contact me directly if you have any further questions or concerns regarding this letter.

Yours sincerely,

Corey Jackson
A/Director of Aquaculture Management Division
Pacific Region, Fisheries and Oceans Canada

cc: A. Paylor
Z. Waddington
I. Keith
C. Doucette
J. Knight

s.21(1)(b)

Manchester, Howie

From: [REDACTED]
Sent: October-06-17 10:14 AM
To: Sandberg, Krista
Cc: Drinkwater, Alisha; Manchester, Howie; Keith, Ian; Diamond, Maria; Charbonneau, Michelle; Marine Harvest Canada Ltd. [REDACTED] Stenhouse, Shawn; [REDACTED] Waddington, Zac; [REDACTED]
Subject: Re: AAR - Pesticides vs Drugs for control of sea lice

Hi Krista,

So for confirmation; If we use Slice, rather than send the notification to AAR prior to administration, we now treat this as any other therapeutant usage and just provide notification within 7 days as per COL 4.5c?

Thanks,



CERMAQ

Phone +1 250-286-0022
Direct +1 250-286-0022 ext. [REDACTED]
Mobile [REDACTED]

Cermaq Canada Ltd.
#203-919 Island Highway
V9W 2C2 Campbell River, BC, Canada

Cermaq.ca [Facebook](#) [Twitter](#)

From: "Sandberg, Krista" <Krista.Sandberg@dfo-mpo.gc.ca>
To: "Marine Harvest Canada Ltd." [REDACTED]
Cc: "Keith, Ian" <Ian.Keith@dfo-mpo.gc.ca>, "Waddington, Zac" <Zac.Waddington@dfo-mpo.gc.ca>, "Manchester, Howie" <Howie.Manchester@dfo-mpo.gc.ca>, "Charbonneau, Michelle" <Michelle.Charbonneau@dfo-mpo.gc.ca>, "Diamond, Maria" <Maria.Diamond@dfo-mpo.gc.ca>, "Stenhouse, Shawn" <Shawn.Stenhouse@dfo-mpo.gc.ca>, "Drinkwater, Alisha" <Alisha.Drinkwater@dfo-mpo.gc.ca>
Date: 06/10/2017 09:47 AM
Subject: AAR - Pesticides vs Drugs for control of sea lice

s.19(1)

Hello,

I have some updates and clarification regarding the 72 hour pesticide deposit notifications required under the AAR.

Pest control products, such as **Hydrogen Peroxide**, are those products that are deposited *directly into the environment*, and have a Pest Control Product (PCP) number.

72 hour notification is required prior to the deposit of a Pest Control Product, under Section 6(d) of the AAR:

Pest control products

6 In the case of a deposit of a pest control product,

- (a) if the pest control product is registered, the owner or operator of the aquaculture facility must use it in compliance with any conditions specified under the Pest Control Products Act, including any conditions relating to the place where it may be used and the quantity and concentration that may be used;
- (b) if the pest control product is not registered, it must be authorized to be used by the owner or the operator under subsection 21(5) or 41(1) of the Pest Control Products Act or have been exempted from registration by a regulation made under paragraph 67(1)(z 4) of that Act
- (c) the owner or the operator must consider, before depositing the pest control product, whether there are alternatives to the deposit of that pest control product and make a record of that consideration, and
- (d) the owner or the operator must notify the Minister, at least 72 hours before the deposit, of the product name of the pest control product and the time, date and geographic coordinates of the deposit

Alternatively, *drugs* may also be used to control pests, but are administered to the fish, and not directly into the environment. These products, such as *Slice*, have a Drug Identifier Number (DIN), and **DO NOT require 72 hour notification** prior to deposit, as per section 5 of the AAR:

Drugs

5 In the case of a deposit of a drug,

- (a) if by or under an Act of Parliament the drug may only be sold under a prescription, it must be prescribed by a person who is duly authorized to practise veterinary medicine
 - (i) under the laws of the province in which the aquaculture facility is located, or
 - (ii) under the laws of any province, if the aquaculture facility is not located in a province,
- (b) the owner or operator of the facility must take measures to minimize the risk of an accidental deposit of the drug, and
- (c) if the drug is deposited to control a pest as defined in the Pest Control Products Act, the owner or operator must consider, before depositing the drug, whether there are alternatives to the deposit of that drug and make a record of that consideration

I know there has been some confusion over the requirements of 72 hour notifications and use of drugs for the control of pests, but I hope that this helps to clear up some of those misconceptions. Please feel free to contact me if you have any other questions.

Cheers,
Krista.

Krista Sandberg

Finfish Aquaculture Biologist | Biologiste de l'aquaculture
Aquaculture Management Division | Gestion de l'aquaculture
Fisheries and Oceans Canada | Pêches et Océans Canada
krista.sandberg@dfo-mpo.gc.ca
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s.16(2)(c)



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Waddington, Zac

From: Sandberg, Krista
Sent: October-10-17 9:33 AM
To: Waddington, Zac
Subject: Re: August sea lice report ready for review

Sent from my BlackBerry 10 smartphone on the Rogers network.

From: Sandberg, Krista
Sent: Tuesday, October 10, 2017 9:30 AM
To: Waddington, Zac
Subject: Re: August sea lice report ready for review

Haha. I'm actually in the airport now heading to Vancouver

My suggestion would be to maybe look at sea lice reporting templates and maybe beef them up a bit to add more details related to treatment plans, if you think that monthly reporting is timely enough? We could make sure that they add future plans including all treatment methods and add to the CoL requirements for these details?

Sent from my BlackBerry 10 smartphone on the Rogers network.

From: Waddington, Zac
Sent: Tuesday, October 10, 2017 8:47 AM
To: Sandberg, Krista
Cc: Manchester, Howie
Subject: RE: August sea lice report ready for review

Yeah I totally agree, I'm not wanting to add another reporting event for them, so much as try to standardize the reporting for sea lice treatments. I was chatting with Howie and he tells me that the AAR stipulates that peroxide treatments need reporting within 72 hours, then SLICE is not nicely captured under any current COL (though I agree monthly reporting works well), and so far as I know, I don't think we have any reporting requirements for the future use of mechanical methods (i.e. hydrolicer, thermolicer)?? This is something to be sorted out before 2022, so we've got time yet. But my hope would be to well define the reporting requirements, making them less onerous but more timely. Do you think this is possible???

Zac

From: Sandberg, Krista
Sent: Tuesday, October 10, 2017 8:33 AM
To: Waddington, Zac
Subject: RE: August sea lice report ready for review

s.19(1)

I think it depends on how timely you want the information. We're getting exceedance reports during outmigration that should include treatment plans, then monthly abundances which also include treatment plans, then quarterly reports

that say how much was used and when. I think that including another report notifying when they are going to treat, and a 7 day followup is kind of overkill, especially if the treatment was proactive area based management rather than in response to a threshold exceedance, or if it was out of the outmigration window in which there is technically no threshold. This is probably a conversation that needs to take place in person, but that's my 2 cents for now ☺

Krista Sandberg

Cellular | Cellulaire [REDACTED]

Office | Bureau 250-286-5835



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From: Waddington, Zac

Sent: Tuesday, October 10, 2017 8:22 AM

To: Sandberg, Krista

Subject: RE: August sea lice report ready for review

Thanks for keeping me in the loop. Howie and I were chatting about this on Friday. I understand that the use of a pesticide does not constitute a fish health event (under our current interpretation); however, I personally think that it ought to. For this current license I agree that if industry reports their SLICE use with their monthly sea lice reports I think that would be as good as we can get. I would like to see our next license include any sea lice treatment as a fish health event, thereby necessitating a report in 7 days. I think it's really important for us to know what's being used, and how often (i.e. for detecting potential resistance issues in an area). What do you think?

Zac

From: Sandberg, Krista

Sent: Tuesday, October 10, 2017 8:08 AM

To: Waddington, Zac

Cc: Keith, Ian; Manchester, Howie

Subject: RE: August sea lice report ready for review

Thanks, Zac. I will send this one off for approval from Adrienne.

Just a side note on Slice notifications. As you've probably seen, we've recently discovered that industry is not required to give a 72 hour notification for Slice deposit under the AAR. [REDACTED] asked me if we wanted this notification to come under section 4 of the CoL, and so I spoke to Ian about it on Friday. We currently get deposit details in the quarterly Mortality by Category reports, and we SHOULD get treatment plans in the monthly Sea Lice reports as well, though this isn't always the case. Some companies are better at communicating their plans in the sea lice reports than others are. Ian is fine with this, and so am I (I hope you are too).

I've got an email from [REDACTED] to myself and industry representatives asking what we are expecting in terms of Slice treatment notifications. I'm thinking of drafting up a response that basically says separate notification isn't necessary as sea lice threshold exceedance or proactive treatment is not considered to be a "fish health event" as is specified in section 4 BUT reminding industry to please be diligent in communicating their treatment plans in the monthly sea lice reports, given the lack of deposit notification requirements under the AAR.

Thoughts?

Krista Sandberg

Cellular | Cellulaire [REDACTED]

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From: Waddington, Zac
Sent: Monday, October 09, 2017 3:15 PM
To: Sandberg, Krista
Subject: RE: August sea lice report ready for review

Heard back [REDACTED] He tells me that Saranac was treated with Oxytet for SRS (Notification was sent Sept 8th) and this was then followed up with a Slice treatment. That started on the 16th. Apparently the notification will be in the quarterly reporting. I've updated the report. Should be good to go now.

Zac

From: Sandberg, Krista
Sent: October-06-17 4:28 PM
To: Waddington, Zac
Subject: August sea lice report ready for review

Hi Zac!

I've got the August sea lice report ready for your review: [X:\1. PUBLIC REPORTING\Sea Lice\Monthly Farm Level \(A\)\2017\Farm Level Sea Lice \(A\) 2017 csv.xlsx](#)

I've highlighted the spots that I need your input in yellow. The biggest thing I noted was that a few Cermaq facilities had exceedances without any comment on action. This isn't really a problem since their monthly averages are still below threshold, AND we are outside of the outmigration window. The only one that could maybe use a comment is Saranac. Their monthly average was over and they are currently treating for a bacterial infection. Your call on this one.

I'm out of the office next week, but going to bring my computer with me and hopefully figure out how to use VPN so I can follow up on this stuff before the 16th when I'm back.

[REDACTED]
Krista.

Krista Sandberg

Finfish Aquaculture Biologist | Biologiste de l'aquaculture
Aquaculture Management Division | Gestion de l'aquaculture
Fisheries and Oceans Canada | Pêches et Océans Canada
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s.19(1)

Manchester, Howie

From: Keith, Ian
Sent: October-10-17 9:38 AM
To: Sandberg, Krista; Waddington, Zac
Cc: Manchester, Howie; Paylor, Adrienne
Subject: RE: August sea lice report ready for review

My comment comes from the process of review by the Auditor General.

Not a criticism of individuals, but Bernie writes the licence conditions, DOJ advises, and industry is consulted. We end up with a regulation that will have gaps.

We are encouraged to use personal/professional relationships between company veterinarians and DFO veterinarians, and company biologists and DFO biologists to assure honest reporting, following the Shared Stewardship philosophy. This is relied upon, something the Auditor General understands, but there are many examples where companies have cited the law when refusing to do what the veterinarians and biologists request.

I recommend using the Bulletin whenever these weakness are found. These should follow the style of Bernie's 3 column document, where the rationale for a bulletin is recorded.

So this isn't a rant but is the background to recommend that your email be followed up with a Bulletin.

Ian

Ian Keith DVM
Field Operations Veterinarian - Pacific Region
Fisheries and Oceans Canada | Pêches et Océans Canada
Fisheries Management
Aquaculture Management Division | Gestion de l'aquaculture
Aquaculture Environmental Operations - Fish Health
#103 - 2435 Mansfield Drive
Courtenay, British Columbia V9N 2M2
Telephone | Téléphone: 250-703-0917
Mobile | Portable: [REDACTED]
Fax | Télécopieur: 250-703-0921
Ian.Keith@dfo-mpo.gc.ca

s.16(2)(c)

s.19(1)

From: Sandberg, Krista
Sent: Tuesday, October 10, 2017 8:08 AM
To: Waddington, Zac
Cc: Keith, Ian; Manchester, Howie
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I've got an email from [REDACTED] to myself and industry representatives asking what we are expecting in terms of Slice treatment notifications. I'm thinking of drafting up a response that basically says separate notification isn't necessary as sea lice threshold exceedance or proactive treatment is not considered to be a "fish health event" as is specified in

section 4 BUT reminding industry to please be diligent in communicating their treatment plans in the monthly sea lice reports, given the lack of deposit notification requirements under the AAR.

Thoughts?

Krista Sandberg

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Office | Bureau 250-286-5835



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From: Waddington, Zac
Sent: Monday, October 09, 2017 3:15 PM
To: Sandberg, Krista
Subject: RE: August sea lice report ready for review

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Zac

From: Sandberg, Krista
Sent: October-06-17 4:28 PM
To: Waddington, Zac
Subject: August sea lice report ready for review

Hi Zac!

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I'm out of the office next week, but going to bring my computer with me and hopefully figure out how to use VPN so I can follow up on this stuff before the 16th when I'm back.

[REDACTED]
Krista.

Krista Sandberg

Finfish Aquaculture Biologist | Biologiste de l'aquaculture
Aquaculture Management Division | Gestion de l'aquaculture
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s.19(1)



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Paylor, Adrienne

From: Paylor, Adrienne
Sent: October-10-17 10:04 AM
To: Lavigne, Lauren; Waddington, Zac
Subject: FW: SOPs for 2.4
Attachments: The-genetics-and-genomics-of-insecticide-resistance_2004_Trends-in-Genetics.pdf; Oct 2017 [REDACTED] re sept 25 call.doc

Ok so this went out to Grieg in the middle of the night over the long weekend basically saying they can not use Slice at Atrevida, Concepcion, Gore, Williamson, Esperanza, Steamer and Hecate. I imagine Corey or Andy will be hearing from them so we better prep for next steps. I spoke briefly to Corey on Friday about the two draft letters I prepared expressing our concerns about Slice application and at that point Corey was fine with vet to vet communication asking for alternative treatment methods in the SOP's. This goes a bit further by stating "emamectin benzoate use will not be permitted on these farms until further notice". Not sure about the rest of the statements in the letter and didn't get much out of the Article attached. Do we need a call about this?

Adrienne

From: Keith, Ian
Sent: Monday, October 09, 2017 2:35 AM
To: [REDACTED]
Cc: Paylor, Adrienne
Subject: SOPs for 2.4

Hi [REDACTED]

Please see the attached. I will be in the office Tuesday should you wish to discuss.

Regards,

Ian

s.19(1)



The genetics and genomics of insecticide resistance

Richard H. ffrench-Constant, Phillip J. Daborn and Gaelle Le Goff

Department of Biology and Biochemistry, University of Bath, Bath BA2 7AY, UK

The past ten years have seen the elucidation of the molecular basis of insect resistance to many chemical insecticides. Target genes, mostly in the nervous system, have been identified and cloned from *Drosophila melanogaster* and resistance-associated mutations have been examined in a range of pest insects. More recently, with the advent of annotated insect genomes, resistance mediated by complex multi-gene enzyme systems such as esterases, cytochrome P450s and glutathione-S-transferases has also been elucidated. In this article, we review the impact of *Drosophila* genetics on the field of insect resistance and focus on the current and future impact of genomics. These studies enable us to address three fundamental questions in the evolution of resistance. How many genes are involved? How many mutations are there within these genes? How often do these mutations arise in natural populations?

Insecticide resistance is an important man-made example of natural selection, and the factors governing the origin and spread of resistance-associated mutations are both of academic and of applied importance. In recent years, most of the genes encoding the targets for small-molecule insecticides have been identified and cloned in the genetic model *Drosophila melanogaster*. Most of these targets are important receptors or enzymes in the insect nervous system whose poisoning leads to rapid paralysis and insect death. The cloning of these resistance genes has enabled us to address fundamental questions relevant to the selection of these adaptive traits. Are resistance phenotypes controlled by one or many genes? How many mutations are there within resistance genes and how many independent origins do they have in field populations [1]? Although most attempts to answer these fundamental questions have been based on target site resistance [2–4], recent advances in insect genomics [5] now facilitate an analysis of more complex metabolic systems [1,6–8].

How many target site genes?

Theory predicts that the number of resistance genes selected to confer resistance depends on whether selection acts within or outside of the phenotypic distribution of the susceptible population (Figure 1). Selection from within this distribution selects preferentially for polygenic resistance, by combining common pre-existing resistance factors that have a minor effect, such as body size and

developmental rate, whereas selection outside of this distribution selects for rare mutations in single genes that have a major effect – a monogenic response [9–11]. Examination of insecticide target-site mutants, isolated in field studies, supports the importance of single genes that

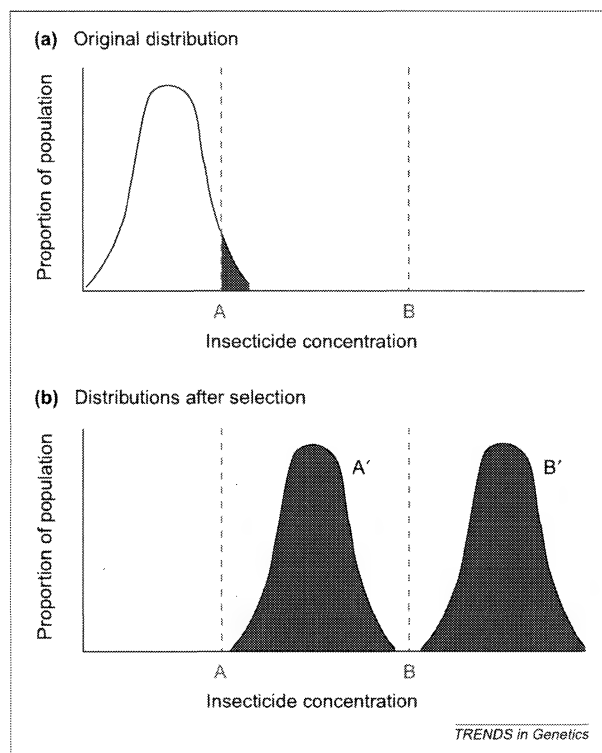


Figure 1. Selection within, and outside of, the normal response of an insect population. Selection within the normal distribution of insecticide tolerance at a concentration indicated by broken line (A) results in the survival of a large number of individuals. These individuals show a marginally enhanced tolerance to insecticide after selection (distribution A'). When repeatedly applied to the same population, such doses of insecticide select for several different resistance traits of minor effect that act cumulatively (polygenic resistance). Selection outside of the normal distribution of tolerance (concentration indicated by the line B) results in the selection of rare mutations that have a major effect within single genes (monogenic resistance). Such mutants show a tolerance distribution (distribution B') that lies outside of the original distribution. The frequency of such rare mutants in laboratory strains can be increased by mutagenesis. Thus, most strains selected continuously in the laboratory, from small genetically-uniform populations and without mutagenesis, show polygenic resistance, whereas most resistant field strains show monogenic resistance [73], provided that additional selection in the laboratory has not been performed. Note that the doses applied in the field are designed to kill all the insects present and are therefore closer to dose B, whereas repeated selection in the laboratory necessitates keeping survivors and uses doses closer to A. (Reproduced with permission from Ref. [9].)

Corresponding author: Richard H. ffrench-Constant (bssrfe@bath.ac.uk).

**Pages 268 to / à 274
are withheld pursuant to section
sont retenues en vertu de l'article**

68(a)

**of the Access to Information Act
de la Loi sur l'accès à l'information**

9 October, 2017

Hi [REDACTED]

A follow-up from your call Monday, 25 September, as we haven't received the Health Management SOPs to date, and the submission date is approaching fast.

To what you had to share in the call as it pertains to SOPs: You said you planned to "peroxide all Nootka." I don't know when or how large the lice recruitment to Gore Island will be but expect you are anticipating recruitment soon and management of lice in Nootka and Esperanza has to be by hydrogen peroxide bath, Hydrolicer or freshwater bath. We were told that these new technologies would allow health management at the Gore Island site, and given the repeated SLICE failures in Nootka last production cycle, these technologies will be required in the cluster of Atrevida, Concepcion, Gore and Williamson, and emamectin benzoate use will not be permitted on these farms until further notice. With the unknowns concerning the SLICE resistance in Esperanza Inlet and 10 months of disseminating these lice in the inlet unchecked, these new technologies will be required in Esperanza, Steamer and Hecate as well, and emamectin benzoate use will not be permitted on these farms until further notice. With the Arriagada et al. (2016) paper describing the seasonal low salinity effects on sea lice biology in the area, management with these new technologies on these farms is feasible, and with the addition of production at Gore and Hecate, the potential lice burden in the area increases and management has to adjust accordingly.

In the last production cycle in Nootka, there was failed SLICE treatment at Atrevida (August 2015) and at Williamson (April 2016). The new production cycle began with stocking of Atrevida in September 2016 and September would provide ideal conditions for infestation with hatch from the resistant lice from the nearest neighbour, Williamson as Williamson fish were not finished harvesting until August. Concepcion was, in turn, stocked in November 2016, and would have been vulnerable to infestation with hatch from the resistant lice from Atrevida (nearest neighbour to Concepcion). These fish are being transferred to Gore so there is risk of direct transfer of resistant lice known in the past production cycle. There is also such close proximity of these source sites to Gore that there is risk of indirect transfer of resistance lice from these neighbouring farms too, removing the advantage that a new site otherwise has in terms of exposure (to pathogens and pests). Gore is therefore at risk for SLICE resistant lice from last production cycle, as are Concepcion, Atrevida and Williamson.

Although male lice from wild fish are expected to breed the resistant females in the fall, and the progeny will be the majority of the winter and spring sets of lice found on Concepcion fish, the bioassay data does not provide sufficient predictability of SLICE efficacy; resistant lice are expected to be amongst the population on the fish from Atrevida and Concepcion. You told me you weren't going to use the opportunity of the transfer to Gore to start the peroxide treatments. [REDACTED]

[REDACTED] that you haven't experience with this well boat as yet. I understand, and also appreciate that preserving the lamellar epithelium is of particular importance to you as these fish will require many peroxide treatments for lice management by the time harvest is complete. However, I am raising my

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s.20(1)(b)

concern that at current temperatures and without the reduction of burden during transfer, equipment should be at the ready.

Your post-treatment tissue drug concentration data from Esperanza and Steamer (September 2016), from no detection to sub-therapeutic to target levels, demonstrates the sub-therapeutic risk that Sonja and I have attributed incremental SLICE resistance to. Grieg staff insisted that "natural" size variation will not be remedied during transfer, or after transfer, and so proper dosage for in-feed treatments of fish won't be possible. Please know [REDACTED] that with the a new feeding system at Gore proper cyclic feeding would be possible to make the food indefensible by dominant fish, implying that in-feed treatments would be possible. In analogous situations, where companies have failed to meet regulatory standards and so have adopted technologies or strategies that they claim will allow them to meet fish health requirements DFO has said that the company would have to prove their claims through two production cycles. There won't be exceptions made for Grieg.

Lastly, reference to incremental increase in resistance made above was deliberate as the resistance seen in Esperanza Inlet requires special attention. The EC_{50} levels in Esperanza Inlet, being well above any we have seen for this fish health zone or any zone, doesn't fit the incremental rise we have seen elsewhere. Factors influencing lice bioassay end points bring uncertainties for interpretation but you repeated the assay and temperatures of the bioassay and the field were very close, so the assay itself appears to be sound. This raises the concern that a different resistance mechanism was selected for and a lot of these lice were produced. (Polygenetic and monogenetic mutation is discussed in the attached paper.) There was anomalously low abundance in 2014 in Esperanza with no evidence of lice recruitment from wild fish in Fall 2014 and at no point was threshold met. Two SLICE treatments (August and December 2014) of what appears to be the same lice population would therefore be at greater risk of selecting for resistant lice and with a smaller population, there could be mechanisms different from what we've seen before. Restocking Steamer after one month fallow, in September 2015 would, as said above for Nootka, fail to break the cycle if there was resistance.

I trust that you have engineers installing the hydrogen peroxide diffusers in the well boat, and the barge fitted for the Hydrolicer so that you are ready when the regulatory abundance threshold is met. The SOPs are expected to reflect these area and farm-specific requirements, complete with disinfection protocols for movement of the well boat and Hydrolicer equipment between Nootka and Esperanza Inlet.

Regards,

Ian Keith

s.19(1)

Paylor, Adrienne

From: Paylor, Adrienne
Sent: October-10-17 2:40 PM
To: Lavigne, Lauren
Subject: FW: Grieg Slice Letter
Attachments: oct Grieg SLICE treatments Option 2 Letter accepted EDITS ik.docx; SOPs for 2.4

I'm getting C&P to review Ian's changes to the formal letter but need your opinion on how we should brief Corey on this.

From: Paylor, Adrienne
Sent: Tuesday, October 10, 2017 2:28 PM
To: Knight, Joe
Subject: Grieg Slice Letter

Hi Joe,

Just to keep you in the loop on this, Ian has notified Grieg's veterinarian that they should not be using Slice at Nootka farms in the attached email that was sent over the weekend. Ian has also made some changes to the draft letter we discussed last week. Please let me know if you have any further advise or comments on this revised draft.

Thanks,

Adrienne Paylor

Regional Manager, Aquaculture Environmental Operations
Fisheries and Oceans Canada / Peches et Oceans Canada
Aquaculture Management Division / Gestion de l'aquaculture
1520 Tamarac Street, Campbell River, BC V9W 3M5
Adrienne.paylor@dfo-mpo.gc.ca

Telephone | Téléphone 250-286-5817
Facsimile | Télécopieur 250-286-5837
Government of Canada | Gouvernement du Canada

From: Keith, Ian
Sent: Tuesday, October 10, 2017 1:51 PM
To: Paylor, Adrienne
Cc: Waddington, Zac
Subject: my edits to the follow up letter to my email

Hi Adirenne,

If you had time to read my email [REDACTED] it is solid in my opinion. I have made some technical changes to the Option 2 letter and hope that C&P has in the letter what is necessary for follow up [REDACTED]

I think all the necessary detail is present. I have not said that SLICE can't be used in Muchalat Channel sites (Muchalat N and S) because there is no hydrologic connectivity and because a recent paper indicated a freshwater lens that should protect fish with direct entry until the summer. However, if these sites are split to stock the Nootka sites, which was the case in the last production cycle i.e. 2015-2016, then Muchalat should be included as areas where SLICE cannot be used.

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Note that the marine to marine accommodation that was made for Grieg long ago means that no farm within Nootka can be treated as independent, that the farms in terms of risk from nearest neighbour should be treated as a 4 farm cluster.

[REDACTED] has not called, something my email invited him to do.
Ian

Dr. Ian Keith DVM
Field Operations Veterinarian - Pacific Region
Fisheries and Oceans Canada | **Pêches et Océans Canada**
Fisheries Management
Aquaculture Management Division | **Gestion de l'aquaculture**
Aquaculture Environmental Operations - Fish Health
#103 - 2435 Mansfield Drive
Courtenay, British Columbia V9N 2M2
Telephone | **Téléphone**: 250-703-0917
Mobile | **Portable**: [REDACTED]
Fax | **Télécopieur**: 250-703-0921
Ian.Keith@dfo-mpo.gc.ca

s.16(2)(c)

s.19(1)



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Pêches et Océans
Canada

Région du Pacifique
Pièce 200 – 401 rue Burrard
Vancouver (C.-B.)
V6C 3S4

Our file Notre référence
2017-XXX-XXXXX

October 10, 2017

Grieg Seafood BC Ltd.

Attn: [REDACTED]

Attn: [REDACTED]

106 - 1180 Ironwood Street
Campbell River, BC, V9W 5P7

RE: PROPOSED SEA LICE TREATMENTS IN NOOTKA

This letter is in response to a recent phone conversation on September 25, 2017 between Ian Keith (DFO) and [REDACTED] (Grieg) regarding the use and application of emamectin benzoate (SLICE) treatments in Nootka Sound. On September 7, 2017 DFO staff participated in a conference call with Grieg management and fish health staff to discuss a number of concerns regarding the stocking of the Gore Island site, which included general fish health management issues at that location and more broadly in Nootka Sound. During the call Grieg communicated that bath treatments, of hydrogen peroxide in a well boat, were planned for sea lice treatment in Nootka Sound, along with options to use freshwater and the Hydrolicer®.

On September 8, 2017 DFO followed up with written concerns and requested a detailed response from Grieg to identify mitigation for the described risks. In particular, items 3 and 4 spoke to the 3) proper dosage for in-feed treatments of fish and 4) the response to a louse outbreak. Grieg's written response on September 11, 2017, again identified alternative lice treatments, but indicated that complete updated Standard Operating Procedures (SOPs) would be submitted by October 15, 2017 in order to maintain compliance with Condition of Licence 4.2. Based on this proposal and the commitment to provide detailed written SOPs on or before October 15, DFO issued Grieg a permit to stock the Gore Island site.

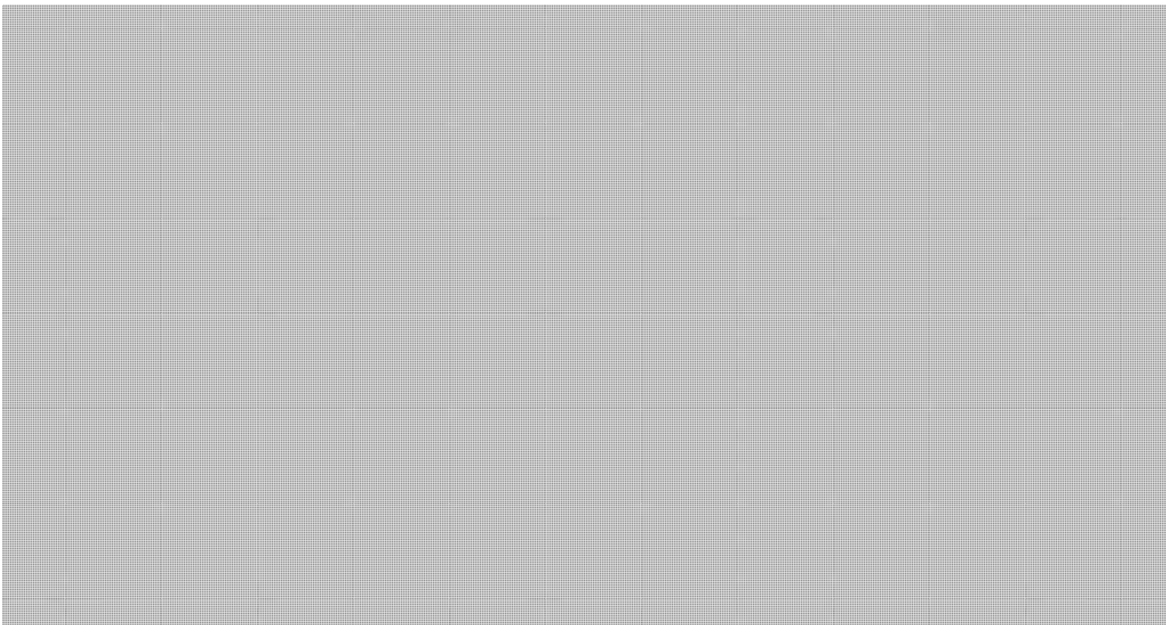
However, during a subsequent phone conversation on September 25, 2017 it came to DFO's attention that Grieg is now considering the use of SLICE in Nootka Sound. I would like to reiterate that with failed SLICE treatment despite new lice recruitment between treatments (Nootka 2015, 2016) and failed SLICE treatment without prior exposure (Esperanza 2016) it is our veterinarians' professional opinion that it is no longer prudent to use this drug in these areas at this time. DFO issued the transfer permit to Gore Island with the understanding that alternate treatments to SLICE would be used and therefore expected to see this reflected in the October 15, 2017 SOP submission for

Canada

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Gore Island, but also for farms that are sources for transfer to Gore and farms with connectivity with Gore Island (Atrevida, Concepcion, Williamson) and the Esperanza Inlet. Please note that any SOPs that do not properly address this concern will be rejected.



Please contact me directly if you have any further questions or concerns regarding this letter.

Sincerely,

Corey Jackson
A/Director of Aquaculture Management Division
Pacific Region, Fisheries and Oceans Canada

cc: A. Paylor
Z. Waddington
I. Keith
C. Doucette
J. Knight

s.21(1)(b)

Paylor, Adrienne

From: Paylor, Adrienne
Sent: October-11-17 4:46 PM
To: Jackson, Corey
Cc: Lavigne, Lauren
Subject: Ian's vet to vet letter send to Greig
Attachments: Oct 2017 [REDACTED] re sept 25 call.doc

Corey this is a copy of the letter Ian sent in the email below to Grieg's vet [REDACTED] over the long weekend (note at 2:30 am on Sunday night). I spoke to Ian end of day Friday before the long weekend and said you and I were not ready to send the formal letter we were working on but that you and I were leaning towards a vet to vet communication stating that we have concerns with the use of slice and expect their SOP's to identify alternative treatment options such as the well boat they told us they were going to use. So I'm sure Ian thought he was ok in sending the email I just didn't know he would send a strongly worded letter that was not vetted by management. Just so you have a copy of what was sent and we will figure out next steps on Friday. Just spoke to Laruen about this as well if you have questions or ideas for her tonight.

Thx Adrienne

From: Keith, Ian
Sent: Monday, October 09, 2017 2:35 AM
To: [REDACTED]
Cc: Paylor, Adrienne
Subject: SOPs for 2.4

Hi [REDACTED]

Please see the attached. I will be in the office Tuesday should you wish to discuss.

Regards,
Ian

s.19(1)

**Pages 282 to / à 283
are duplicates of
sont des duplicatas des
pages 275 to / à 276**



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Our file Notre référence
2017-XXX-XXXXX

October 5, 2017

Grieg Seafood

Attn: [REDACTED]

106 - 1180 Ironwood Street
Campbell River, BC, V9W 5P7

RE: PROPOSED SEA LICE TREATMENTS IN NOOTKA

This letter is in response to our recent phone conversation of September 25, 2017 and concerns regarding the use and application of SLICE© treatments in Nootka Sound and Esperanza Inlet. On September 7, 2017 DFO staff participated in a conference call with Grieg management and fish health staff to discuss a number of concerns regarding the stocking of the Gore Island site, which included general fish health management issues at that location and more broadly in Nootka Sound. During this call Grieg communicated that bath treatments of hydrogen peroxide in well boats were planned for sea lice treatment in Nootka Sound, along with options to employ freshwater and the Hydrolyser®.

On September 8, 2017 DFO followed up with written concerns and requested a detailed response from Grieg to identify mitigation for the identified risks. In particular, items 3 and 4 spoke to the proper dosage of fish for in-feed treatments and the response to a louse outbreak. Grieg's written response on September 11, 2017, again identified alternative lice treatments, but indicated that complete updated Standard Operating Procedures (SOPs) would be submitted by October 15, 2017 in order to maintain compliance with Condition of Licence 4.2. Based on the proposal discussed and the commitment of detailed written SOPs on or before October 15, DFO issued Grieg a permit to stock the Gore Island site.

However, during the phone conversation of September 25, it came to our attention that you are now considering the use of SLICE in Nootka Sound. I would like to reiterate that there is growing evidence and concern of a failed response to SLICE in Nootka Sound and Esperanza Inlet and it is my professional opinion that it is longer prudent to use this drug in these areas at this time. You have shared bioassay and treatment results that support this position. DFO issued the transfer permit to Gore Island with the understanding that alternate treatments and not SLICE would be used, and we expect to see reflected that in the October 15 SOP submission for Gore Island, but also for all

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Canada

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farms in Nootka Sound and Esperanza Inlet. Please note that we will reject any SOPs that do not properly address this concern.

Please contact me directly if you have any further questions or concerns regarding this letter.

Yours sincerely,

Ian Keith

Operational Veterinarian, Aquaculture Environmental Operations
Pacific Region, Fisheries and Oceans Canada

cc: A. Paylor
Z. Waddington
C. Jackson
C. Doucette
J. Knight

Keith, Ian

From: Keith, Ian
Sent: October-11-17 7:48 PM
To: Waddington, Zac
Subject: FW: SL slice bioassay papers
Attachments: bioassay interpretation westcott.pdf; summary from westcott & from Stone.pdf

Here are my historic notes from having read Wescott and having read Stone et al. (2002). Wescott et al. (2008) says that time and between lice variability are good for descriptive studies but not resistance. Stone shows gendre differential response to slice.

From: Keith, Ian
Sent: October-11-17 7:39 PM
To: Waddington, Zac
Subject: SL slice bioassay papers

I made no reference to prediction and bioassay in the email but this paper by AVC is early work where they compared EC_{50} F1s i.e. progeny from hatched eggs from sea lice used in the bioassay, with the EC_{50} from the sea lice from the field. There is some efficacy data but it is moreso the bioassay dependability that is described.

Optimization and field use of a bioassay to monitor sea lice *Lepeophtheirus salmonis* sensitivity to emamectin benzoate

Jillian D. Westcott¹, Henrik Stryhn¹, John F. Burka², K. Larry Hammell^{1,3,*}

¹Department of Health Management, ²Department of Biomedical Sciences, and ³AVC Centre for Aquatic Health Sciences, Atlantic Veterinary College, University of Prince Edward Island, Charlottetown, Prince Edward Island C1A 4P3, Canada

ABSTRACT: A bioassay for sea lice *Lepeophtheirus salmonis* sensitivity towards emamectin benzoate (EMB) was validated for field use. A probit regression model with natural responsiveness was used for the number of affected (moribund or dead) sea lice in bioassays involving different concentrations of EMB. Bioassay optimization included an evaluation of the inter-rater reliability of sea lice responsiveness to EMB and an evaluation of gender-related differences in susceptibility. Adoption of a set of bioassay response criteria improved the concordance (evaluated using the concordance correlation coefficient) between raters' assessments and the model estimation of EC₅₀ values (the 'effective concentration' leading to a response of 50% of the lice not prone to natural response). An evaluation of gender-related differences in EMB susceptibility indicated that preadult stage female sea lice exhibited a significantly larger sensitivity towards EMB in 12 of 19 bioassays compared to preadult males. In order to evaluate sea lice sensitivity to EMB in eastern Canada, the intensive salmon farming area in the Bay of Fundy in southwestern New Brunswick was divided into 4 distinct regions based on industry health management practices and hydrographics. A total of 38 bioassays were completed from 2002 to 2005 using populations of preadult stage sea lice collected from Atlantic salmon *Salmo salar* farms within the 4 described regions. There was no significant overall effect of region or year on EC₅₀ values; however, analysis of variance indicated a significant effect of time of year on EC₅₀ values in 2002 and a potential effect in 2004 to 2005. Although the range of EC₅₀ values obtained in this 3 yr study did not appear sufficient to affect current clinical success in the control of sea lice, the results suggest a seasonal- or temperature-associated variation in sensitivity to EMB. This will need to be considered if changes in EMB efficacy occur in the future.

KEY WORDS: Sea lice · *Lepeophtheirus salmonis* · Emamectin benzoate · SLICE® · Bioassay · Gender-difference · Inter-rater reliability · Field monitoring

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INTRODUCTION

Sea lice *Lepeophtheirus salmonis* are ectoparasitic, copepodid crustaceans capable of inflicting serious physical damage upon their salmonid hosts if not managed carefully at commercial salmon culture sites (Ramstad et al. 2002). The requirement for continual monitoring and control of sea lice is a costly economic burden for Atlantic salmon *Salmo salar* producers throughout North America and northern Europe (Costello 1993, Treasurer & Pope 2000). Although

there are a number of biological and chemical means of sea lice management and control, reduced sensitivity and resistance development of sea lice towards several chemotherapeutants have been reported (Jones et al. 1992, Treasurer et al. 2000, Tully & McFadden 2000, Sevatdal & Horsberg 2003, Fallang et al. 2004).

An important principle of preventing or minimizing the development of resistance is the avoidance of reliance on single products, or on those treatments most likely to select for the same mechanism of resistance (Denholm et al. 2002). This is often difficult when

*Corresponding author. Email: lhammell@upei.ca

**Pages 288 to / à 299
are withheld pursuant to section
sont retenues en vertu de l'article**

68(a)

**of the Access to Information Act
de la Loi sur l'accès à l'information**

Keith, Ian

From: Keith, Ian
Sent: October-11-17 8:07 PM
To: Waddington, Zac
Subject: slice use in nootka and esperanza plus counts for steamer and esperanza
Attachments: emamectin Esperanza and Nootka.xls

Please find the spreadsheet giving the slice used since 2010 in Esperanza/Nootka and counts for the critical production cycle before the spectacular failure in Esperanza. I proposed that the previous production cycle in Esperanza risked selection for resistance and [REDACTED] said that he learned after treating Steamer and Esperanza that there was some strangeness in the inlet.

These plus the literature determine the regulation direction.

I got a commitment from Lauren, Karen, March and Adrienne at the BCARP meeting, in front of everyone, that they would support adaptive management for SL management by Grieg in 2.4., [REDACTED]
[REDACTED]

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2014 June	1079 Grieg Steamer	2.4 1	0.2	0.8	0.0	0.2	0.0	0.0	1st count precluded by recent transfer
2014 July	1079 Grieg Steamer	2.4 1	2.3		0.1		1.9	0.0	1
2014 August	1079 Grieg Steamer	2.4 2	0.3		0.1		1.3	0.0	
2014 September	1079 Grieg Steamer	2.4 1	0.5		0.2		0.0	0.0	
2014 October	1079 Grieg Steamer	2.4 1	0.8	0.8	0.2	0.2	0.0	0.1	0.1
2014 November	1079 Grieg Steamer	2.4 2	0.1		0.1		0.0	0.0	
2014 December	1079 Grieg Steamer	2.4 1	0.4		0.3		0.0	0.0	
2015 January	1079 Grieg Steamer	2.4 1	0.2		0.1		0.0	0.0	
2015 February	1079 Grieg Steamer	2.4 1	0.1		0.0		0.0	0.0	
2015 March	1079 Grieg Steamer	2.4 2	0.1		0.0		0.0	0.0	
2015 April	1079 Greig Steamer	2.4 2	0.0		0.1		0.0	0.0	2
2015 May	1079 Greig Steamer	2.4	0.1	3.4	0.0		0.0	0.0	Count from 1
2015 June	1079 Greig Steamer	2.4 2	1.3		0.4	0.6	0.1	0.1	0.1 On day of 12

2014 June	1863 Grieg Esperanza	2.4	3	0.1	1.1	0.0	0.3	0.0	2.5	0.0	4.3	0.0
2014 July	1863 Grieg Esperanza	2.4 1		1.2		0.3		2.6		0.6		
2014 August	1863 Grieg Esperanza	2.4	1	2.4		1.3		0.6		0.0		
2014 September	1863 Grieg Esperanza	2.4 1		0.2		0.1		0.0		0.0		
2014 October	1863 Grieg Esperanza	2.4 1		0.6		0.3		0.0		0.0		
2014 November	1863 Grieg Esperanza	2.4	1	0.5		0.2		0.0		0.0		
2014 December	1863 Grieg Esperanza	2.4 1		0.6		0.4		0.0		0.0		
2015 January	1863 Grieg Esperanza	2.4	1	0.2		0.2		0.0		0.0		
2015 February	1863 Grieg Esperanza	2.4 1		0.0		0.0		0.0		0.0		
2015 March	1863 Grieg Esperanza	2.4	2	0.1		0.0		0.0		0.0		
2015 April	1863 Greig Esperanza	2.4 2		0.0		0.0		0.0		0.0		
2015 May	1863 Greig Esperanza	2.4 2		0.0		0.0		0.0		0.0		
2015 June	1863 Greig Esperanza	2.4 1		0.3		0.1		0.0		0.1		

4.3 Statistical agreement with farm count on audit day
1

2
2nd count | 2

Best available copy

Quarterly (Year mo)	Fish Health zone	Aquaculture licence # (AQFF AQ000 2012)	Land tenure #	Company name	Facility name	Fish type cultured	Fish lot type	Therapeutic t(s) used	Weight of active therapeut ant(s) used (kg)
201010					Williamson			Emamectin	
201103					Esperanza, Hecate Channel			Emamectin	
201103					Steamer Point, Hecate Channel			Emamectin	
201110	2.4				Muchalat N			Emamectin	
201112	2.4				Williamson			Emamectin	
201112	2.4				Concepcion			Emamectin	
201112	2.4				Atrevida			Emamectin	
201301		2.4 105794 2012	1411064	Grieg Seafood	Muchalat South	Atlantic	Production	Emamectin Be	0.525
201310 2-4		105788 2012	1405634	Grieg Seafood	Concepcion	Atlantic salmon	Production	Emamectin	0.28
201408 1079		2-4	108328		Steamer Point, Hecate Atlantic Salmon			Emamectin	
201408 2-4			108466		Esperanza, Hecate Cr Atlantic Salmon			Emamectin	
201409 1700		2-4	108404		Muchalat Inlet South, Atlantic Salmon			Emamectin	0.2262
201409 1849		2-4	108406		Muchalat Inlet North, Atlantic Salmon			Emamectin	
201412 1863		2-4	108466		Esperanza, Hecate Cr Atlantic Salmon			Emamectin (0.2888 kg us	
201412 1079		2-4	108328		Steamer Point, Hecate Atlantic Salmon			Emamectin	0.65247
201502					Muchalat Inlet North, Nootka Sound			Emamectin	0.78164
201502					Muchalat Inlet South, Nootka District		s.20(1)(b)	Emamectin	0.24928
201503					Concepcion			Emamectin	
201503					Muchalat Inlet North, Nootka Sound			Emamectin	
201503					Muchalat Inlet South, Nootka District			Emamectin	
201508					Atrevida			Emamectin	
201604					Williamson			Emamectin	
201609					Steamer Point, Hecate Channel			Emamectin	
201609					Esperanza, Hecate Channel			Emamectin	

Note that all Atrevida received treatment in August and counts did not drop over September and October. November counts were still above threshold

Note that Williamson received treatment in April and counts did not drop over May, June, July through harvest.

Note that Steamer received treatment in September and counts did not drop over October, November, December, through harvest

Emamectin	0.7051
Emamectin	0.3875
Emamectin	0.4

Keith, Ian

From: Keith, Ian
Sent: October-12-17 1:04 AM
To: Waddington, Zac
Subject: nearest neighbour and proximity & resistance
Attachments: connectivity norway.pdf; transcriptome analysis of lice resistance.pdf; consensus assessment.pdf; no cost to retain resistance & hybrid reduced resistance.pdf; detection of EMB tolerance emergence 2013.pdf; bioassay and SLICE.pdf

Again, I didn't say in the email [REDACTED] that bioassays fail to predict efficacy, but it is a conclusion of Helgesen and Horsberg (2013) who also say "treatment failures may be caused by factors other than resistance, such as differences in feed intake between individual fish (Berg & Horsberg 2009). Bioassays may thus fail in predicting the outcome of such treatments." Espedal et al. 2013 (no cost to retain resistance & hybrid reduced resistance) in Discussion 4.1 they make the statement about bioassay not directly predicting the strain tolerance to EB on a treated fish.

The obvious reasons are given i.e. bath versus ingestion, but with the way Grieg is encouraging size variation we know that there isn't going to be uniform therapeutic dosing so add this to the mechanisms that might influence how much drug the louse will consume through ingestion. To this add that they are using modelling to get weights rather than sample weights and bingo, the bioassay won't predict. (Note that Espedal et al. talks about knock-down resistance i.e. the monogenic resistance at the target site, but I didn't suggest that this is what we should interpret from the Esperanza bioassay, only that they are very different than anything we have seen before.)

I argued that indirect sea lice transmission from nearest neighbour is real. The Kristoffersen et al. 2014 paper (connectivity Norway) supports this.

The risk of resistant lice in the population because of linkage with the previous production cycle where resistant lice were selected for 6 months before restocking is the reason why I cite the Kristoffersen et al. paper. Although [REDACTED] has a recent bioassay from Nootka that he has argued is reason for him treating with SLICE, the difficulty in detecting the resistant lice within the lice population is summarized by Jones et al. (2013) (detection of EMB tolerance emergence). "A major challenge in the detection of tolerance emergence can be the typically low proportion of resistant individuals in a population during the early phases."

"A major obstacle with early detection of resistance is that during the preliminary stages, the genes conferring resistance occur at such low frequency in a population that detection can be challenging, if not impossible. Typically, by the time drug resistance becomes evident in a population through documentation of multiple treatment failures, the resistant alleles are already prevalent in the population. Genes conferring resistance to a particular parasiticide likely already exist in the population and resistance emergence is inevitable because the use of the treatment selects for these resistance factors."

They conclude: "Variability in both bioassays and treatment response analysis reflects the fact that resistance emergence is a dynamic process and prediction of changes in sea lice sensitivity is challenging. No single method is likely to suffice for monitoring sea lice sensitivity."

Saksida et al. (2013) (see bioassay and SLICE) reported male *L. salmonis* collected from fish in their second year at sea EC50 195.4 ppb and 1st year, 129.4 ppb, and for females, 112.3 ppb (SE = 40.7). These are higher than [REDACTED] recent bioassay for Nootka and Klemtu bioassays are higher than this now. But Klemtu had mixed year classes and moderate salinities; Nootka has low salinities and single year class – they should be able to keep SLICE efficacious as Sonja said often [REDACTED] We need them to correct problems early on. Back to back failure with SLICE, and essentially no fallow, and they are now going to treat with SLICE? [REDACTED]

s.19(1)

s.21(1)(b)

What we want to prevent is the situation in Bay of Fundy, where they are using 150ug per kg, triple the label dosage. We have to learn from their mistakes, just as having to not let BKD get out of hand.

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Space-Time Modelling of the Spread of Salmon Lice between and within Norwegian Marine Salmon Farms

Magne Aldrin^{1,2*}, Bård Storvik¹, Anja Bråthen Kristoffersen^{3,4}, Peder Andreas Jansen³

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Abstract

Parasitic salmon lice are potentially harmful to salmonid hosts and farm produced lice pose a threat to wild salmonids. To control salmon lice infections in Norwegian salmonid farming, numbers of lice are regularly counted and lice abundance is reported from all salmonid farms every month. We have developed a stochastic space-time model where monthly lice abundance is modelled simultaneously for all farms. The set of farms is regarded as a network where the degree of contact between farms depends on their seaway distance. The expected lice abundance at each farm is modelled as a function of i) lice abundance in previous months at the same farm, ii) at neighbourhood farms, and iii) other, unspecified sources. In addition, the model includes explanatory variables such as seawater temperature and farm-numbers of fish. The model gives insight into factors that affect salmon lice abundance and contributing sources of infection. New findings in this study were that 66% of the expected salmon lice abundance was attributed to infection within farms, 28% was attributed to infection from neighbourhood farms and 6% to non-specified sources of infection. Furthermore, we present the relative risk of infection between neighbourhood farms as a function of seaway distance, which can be viewed as a between farm transmission kernel for salmon lice. The present modelling framework lays the foundation for development of future scenario simulation tools for examining the spread and abundance of salmon lice on farmed salmonids under different control regimes.

Citation: Aldrin M, Storvik B, Kristoffersen AB, Jansen PA (2013) Space-Time Modelling of the Spread of Salmon Lice between and within Norwegian Marine Salmon Farms. PLoS ONE 8(5): e64039. doi:10.1371/journal.pone.0064039

Editor: Martin Krkosek, University of Toronto, Canada

Received: November 6, 2012; **Accepted:** April 10, 2013; **Published:** May 20, 2013

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Funding: This work was funded by the Research Council of Norway project PREVENT, "Salmon lice-prevention and treatment," project number 199778/540. The funders had no role in study design, data collection and analysis, decision to publish, or preparation of the manuscript.

Competing Interests: The authors have declared that no competing interests exist.

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Introduction

Infectious diseases constitute a constant problem in industrialised farming where there typically are both high densities of farms and high densities of animals within each farm. Disease outbreaks can have large economic consequences to farming industries, but can also have severe ecological effects if infections are spread to and impair the viability of wild animals. Several mathematical and statistical models within this field have been developed during the last decades and applied to as diverse diseases as foot-and-mouth disease, swine fever, bluetongue and infectious salmon anaemia [1–5]. In all these models, probabilities of infection relative to distance, often called transmission kernels [1,4], play an important role.

Salmon lice (*Lepeophtheirus salmonis*) are parasitic copepods that live on the skin surface of both wild and farmed salmonids. The parasite uses rasping mouthparts to feed on mucus, skin and underlying tissues of its host and thereby causes mechanical damage [6]. Possible effects of salmon farming on sea lice infections on wild stocks of salmonids, and hence the viability of such wild stocks, has evoked a large and contentious debate [7–9]. Nevertheless, the notion that salmon farming does affect local transmission of salmon lice to wild salmonids [9,10], as well as to farmed salmonids [11], seems well established. Recent studies also report that parasiticide-treatment of outwardly migrating salmon smolts significantly increases their marine survival compared to

non-treated control smolts, suggesting that salmon lice induce mortality in wild salmonid hosts [12–14]. Due to the potential impact of salmon lice of farm origin on wild stocks of salmonids, salmon lice infections on farmed fish are strictly regulated in Norway [11]. To enforce these regulations, numbers of salmon lice are counted on samples of farmed salmonids at regular intervals from all actively producing marine fish farms each month. Salmon lice abundances from these counts, i.e. the average number of salmon lice per fish, are reported to a central data base [11]. Measures to control salmon lice infections, i.e. the application of medical treatments or the use of cleaner-fish to prey on lice, are also reported to this same data base.

The large spatio-temporal dataset covering salmon lice abundance on salmon farms, and efforts to control these infections, should give insight into factors that affect farm levels of salmon lice infections and the contributing sources for such infection. The aim of the present study was to develop a modelling framework that could: i) disentangle different contributing sources of salmon lice infections; ii) estimate functional relationships between expected salmon lice infections and contributing factors, e.g. the between farm transmission kernel as a function of seaway distance between farms [1,4]; and iii) lay the foundation for a scenario simulation tool to examine the potential spread of salmon lice within and between salmon farms to assess the impact of control measures. We developed a stochastic space-time model where the monthly

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ORIGINAL ARTICLE

Transcriptomic responses to emamectin benzoate in Pacific and Atlantic Canada salmon lice *Lepeophtheirus salmonis* with differing levels of drug resistanceBen J. G. Sutherland,^{1,2} Jordan D. Poley,³ Okechukwu O. Igboeli,³ Johanna R. Jantzen,¹ Mark D. Fast,³ Ben F. Koop¹ and Simon R. M. Jones⁴¹ Centre for Biomedical Research, Department of Biology, University of Victoria, Victoria, BC, Canada² Institut de Biologie Intégrative et des Systèmes (IBIS), Département de biologie, Université Laval, Québec, QC, Canada³ Hoplite Lab, Department of Pathology and Microbiology, Atlantic Veterinary College, University of Prince Edward Island, Charlottetown, PEI, Canada⁴ Pacific Biological Station, Nanaimo, BC, Canada**Keywords**

drug resistance, emamectin benzoate, polygenic resistance, salmon aquaculture, sea lice, transcriptomics.

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Received: 31 July 2014

Accepted: 16 November 2014

doi:10.1111/eva.12237

Abstract

Salmon lice *Lepeophtheirus salmonis* are an ecologically and economically important parasite of wild and farmed salmon. In Scotland, Norway, and Eastern Canada, *L. salmonis* have developed resistance to emamectin benzoate (EMB), one of the few parasiticides available for salmon lice. Drug resistance mechanisms can be complex, potentially differing among populations and involving multiple genes with additive effects (i.e., polygenic resistance). Indicators of resistance development may enable early detection and countermeasures to avoid the spread of resistance. Here, we collect sensitive Pacific *L. salmonis* and sensitive and resistant Atlantic *L. salmonis* from salmon farms, propagate in laboratory (F1), expose to EMB in bioassays, and evaluate either baseline (Atlantic only) or induced transcriptomic differences between populations. In all populations, induced responses were minor and a cellular stress response was not identified. Pacific lice did not upregulate any genes in response to EMB, but downregulated degradative enzymes and transport proteins at 50 ppb EMB. Baseline differences between sensitive and now resistant Atlantic lice were much greater than responses to exposures. All resistant lice overexpressed degradative enzymes, and resistant males, the most resistant group, overexpressed collagenases to the greatest extent. These results indicate an accumulation of baseline expression differences related to resistance.

Introduction

Development of parasiticide resistance in endo- and ecto-parasites of importance to veterinary or human health is a major issue globally. Chemical control is ubiquitous across

many parasite taxa, with administration ease and initial efficacy leading to over-reliance, and in some cases resistance (Sangster 2001). For example, trichostrongylid nematode parasites of sheep are commonly resistant to the major classes of anthelmintics, which can limit sheep

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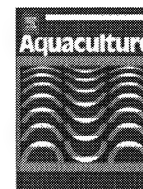
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Short communication

Towards a consensus: Multiple experiments provide evidence for constitutive expression differences among sexes and populations of sea lice (*Lepeophtheirus salmonis*) related to emamectin benzoate resistance



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ARTICLE INFO

Article history:

Received 10 April 2015
Received in revised form 8 June 2015
Accepted 16 June 2015
Available online 18 June 2015

Keywords:

Salmon aquaculture
Sea lice
Drug resistance
Emamectin benzoate (EMB)
Acetylcholine receptors

ABSTRACT

Sea lice (*Lepeophtheirus salmonis*) are ectoparasitic copepods that impose a heavy financial burden on the salmon aquaculture industry. A parasiticide, emamectin benzoate (EMB; trade name SLICE®), was widely used to control sea lice before EMB resistant strains of lice emerged. Several genetic mechanisms are likely responsible for EMB resistance however these are not yet fully understood. Resistance is further complicated by sex differences in EMB tolerance with males often showing better survival upon EMB exposure compared to females. Here, candidate EMB-resistance genes were used to explore differences between sex, population, and exposure to EMB using two in vitro bioassays and an in vivo experiment. Two acetylcholine receptor subunits (*nAChRα3* and *nAChRα7*) showed opposite expression profiles across the assays, with male and EMB-resistant lice showing significant overexpression of *nAChRα7* and downregulation of *nAChRα3* compared to females and EMB-sensitive lice, respectively. Furthermore, a novel gene candidate *LR9* showed induced expression upon EMB exposure with the highest expressing group being EMB-resistant males. An ABC transporter, *pgp*, also showed highest expression in EMB-resistant males but this finding was not consistent across all experiments. Other gene candidates like *CYP18A* and *peroxinectin* did not show similar expression profiles to work completed on other populations or species of sea lice. These data have provided a consensus with other transcriptomic studies showing that neuronal acetylcholine receptor subunits are differentially regulated between sexes and populations of sea lice. This unique expression profile, alongside analysis of other EMB resistance genes, provides a detailed snapshot of mechanisms responsible for resistance in sea lice.

Statement of relevance: Sea lice are a major threat to salmon aquaculture and its' sustainability. With the advent of drug resistance, this problem has only become more troubling. The mechanisms of resistance are largely unknown, with a requirement on consensus findings across meta-populations of lice due to varying levels of resistance within them. This project shows consensus findings across multiple experiments for both previously explored targets as well as new, potential resistance markers.

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1. Introduction

Chemical therapeutants are currently the most effective methods for controlling sea lice, *Lepeophtheirus salmonis* (Kroyer, 1837) and *Caligus* spp. infestations in salmonid aquaculture (Burrige et al., 2010; Denholm et al., 2002). These treatments include bath-administered pesticides like hydrogen peroxide, organophosphates, and pyrethroids, as well as in-feed drugs from the avermectin and benzoylurea classes (Burrige et al., 2010). However, the aquaculture industry has become over-reliant on these treatment options and consequently, resistance has been reported to the majority of available therapeutants (reviewed in Aaen et al., 2015). Understanding the mechanisms responsible for

resistance is vital to improving management strategies and development of future therapeutants for sea lice.

Avermectins are a class of drugs traditionally used for treating both human and livestock parasitic worm infections including heartworm disease, onchocerciasis, and river blindness (Shoop et al., 1995). The use of avermectins is also well documented in Atlantic salmon aquaculture with the administration of Ivermectin (IVM) and Emamectin benzoate (EMB) as sea lice treatments (Horsberg, 2012). In salmon, EMB is administered as an in-feed treatment over a seven-day period at 50 µg/kg fish biomass per day (Ramstad et al., 2002). The drug is distributed to the mucus, skin, and blood of the fish, reaching tissue-specific maximum concentrations between 75–128 ppb (Sevatdal et al., 2005). Lice are exposed to EMB through ingestion of these tissues and potentially through direct contact with the skin and mucus. Upon absorption by the louse, EMB acts on glutamate-gated chloride channels (GluCl[−]), forcing

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Emamectin benzoate resistance and fitness in laboratory reared salmon lice (*Lepeophtheirus salmonis*)

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ARTICLE INFO

Article history:

Received 4 June 2013

Received in revised form 31 August 2013

Accepted 2 September 2013

Available online 11 September 2013

Keywords:

Salmon louse

Lepeophtheirus salmonis

Emamectin benzoate

Sensitivity

Resistance

Fitness

ABSTRACT

Reduced sensitivity to the avermectin emamectin benzoate (EB) was suspected in salmon lice, collected from five Norwegian salmon farms located in Middle and Western Norway in the period January 2008–February 2009. After being transferred to the laboratory, lice from each farm were compared to an EB sensitive laboratory strain (LsGulen, collected from the field in June 2006) using bioassays. All five samples were thereafter confirmed as displaying reduced sensitivity to EB. A strain (LsAustevoll) based upon lice from one of these farms was subsequently established in the laboratory. LsAustevoll was compared to the EB sensitive strain, LsGulen, for 4 generations. A hybrid strain (LsHybrid), established by crossing LsGulen and LsAustevoll, was included in the comparisons for 3 generations. Sensitivity to EB was assessed for each generation, and the fitness parameters: egg production, hatching success and copepodid survival were assessed for selected generations. LsAustevoll retained reduced sensitivity to EB throughout all four generations, while LsHybrid displayed intermediate EB sensitivity to its parental strains. No fitness costs associated with reduced EB sensitivity were detected for any of the parameters studied.

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1. Introduction

The ectoparasitic salmon louse (*Lepeophtheirus salmonis* Krøyer, 1837) (Copepoda) represents a major economic and health related threat to the salmonid aquaculture industry, as well as to wild salmonids. The salmon louse feeds on mucus, skin and blood of salmonids (Brandal et al., 1976), causing local erosions in the epidermis of the host. If the louse intensity is high enough, dermis and subcutaneous tissue can become exposed, seriously compromising the host's capability of osmoregulation and its first line of defence (Pike and Wadsworth, 1999). A high infection level also causes chronic stress in the host, including changes in gene-regulation (Skugor et al., 2008; Tadiso et al., 2011), which further impairs osmoregulation and immune responses, as well as having negative effects on growth, reproduction and survival (Tully and Nolan, 2002).

Sea lice are currently controlled by several approaches including the use of medical treatments, biological measures such as cleaner fish (Costello, 1994; Treasurer, 1993, 2002), as well as farm management and governmental enforced regulations. However, commercial salmon

farming is more or less dependent on efficient medicines. There are a very limited number of available sea lice medicines and the availability varies between countries. In Norway, there are currently six different options, comprised of the following: two pyrethroids (cypermethrin and deltamethrin), one avermectin (emamectin benzoate (EB)), one organophosphate (azamethiphos), and two benzamides (diflubenzurone and teflubenzurone). The most widely used types are pyrethroids, EB and azamethiphos. In addition, the strong oxidizing agent H₂O₂ has been used to remove sea lice from farmed fish in some situations.

The avermectin EB, which is administered to fish via the feed, has been widely used since its introduction to the aquaculture industry in 1999. EB has become the dominating medicine used against sea lice (Burridge et al., 2010), probably because of its ease of administration, its efficacy, and the fact that there are currently no comparable alternatives. However, there are reports of increased tolerance towards EB, or suggestions thereof, in *L. salmonis* in the Atlantic (Helgesen and Horsberg, 2013; Jones et al., 2012; Lees et al., 2008b), and also in *Caligus rogercresseyi* in Chile (Bravo et al., 2008).

Development of increased tolerance and resistance to antiparasitic drugs is one of the most severe negative side effects related to the control of parasites. Resistance can develop by two primary mechanisms, namely through (1) target site insensitivity to the chemical and through (2) metabolic decrease in availability of the chemical at the target site (Feyereisen, 1995). The most severe type is point mutation(s) in the target site gene resulting in no or very low binding between the administered chemical and its target, commonly referred to as knock-down

Abbreviations: CI, confidence interval(s); DPC, days post challenge; EB, emamectin benzoate; EC₅₀, half maximal effective concentration(s); IMR, Institute of Marine Research; KDR, knock-down resistance.

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Detection of emamectin benzoate tolerance emergence in different life stages of sea lice, *Lepeophtheirus salmonis*, on farmed Atlantic salmon, *Salmo salar* L.

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² Department of Mathematics and Statistics, University of Strathclyde, Glasgow, Scotland, UK

Abstract

Emamectin benzoate has been used to treat sea lice, *Lepeophtheirus salmonis*, infestations on farmed Atlantic salmon, *Salmo salar*. Recent evidence suggests a reduction in effectiveness in some locations. A major challenge in the detection of tolerance emergence can be the typically low proportion of resistant individuals in a population during the early phases. The objectives of this study were to develop a method for determining differences in temporal development of tolerance between sea lice life stages and to explore how these differences might be used to improve the monitoring of treatment effectiveness in a clinical setting. This study examined two data sets based on records of sea lice abundance following emamectin benzoate treatments from the west coast of Scotland (2002–2006) and from New Brunswick, Canada (2004–2008). Life stages were categorized into two groups (adult females and the remaining mobile stages) to examine the trends in mean abundance and treatment effectiveness. Differences in emamectin benzoate effectiveness were found between the two groups by year and location, suggesting that an important part of monitoring drug resistance development in aquatic ectoparasites may be the need to focus on key life stages.

Keywords: Atlantic salmon, emamectin benzoate, *Lepeophtheirus salmonis*, resistance detection, sea lice, treatment effectiveness.

Introduction

The development of treatment resistance in sea lice has become problematic for salmon-farming regions around the world. Increased tolerance has been noted in sea lice for dichlorvos and azamethiphos (organophosphates) in Scotland and Norway (Jones, Sommerville & Wootten 1992; Roth *et al.* 1996; Fallang *et al.* 2004). Resistance in sea lice to azamethiphos has been documented at a molecular level in adult female sea lice, *Lepeophtheirus salmonis* (Krøyer, 1837), from Canada and Norway (Fallang *et al.* 2004). There have been anecdotal reports of pyrethroid treatment failures in Scotland (Sevattal *et al.* 2005). Reduced sensitivity to deltamethrin through the use of bioassays has been documented in a population of sea lice in Norway with a history of treatment failures (Sevattal & Horsberg 2003). Reductions in emamectin benzoate treatment efficacy have been demonstrated through the use of field data collected in Scotland (Lees *et al.* 2008a,b) and the Bay of Fundy region of Atlantic Canada (Jones *et al.* 2012), but not in British Columbia, Canada (Saksida, Morrison & Revie 2010). A reduction in the sensitivity of sea lice to emamectin benzoate based on laboratory bioassays has been documented in Chile, although the predominant species of sea lice in that region is *Caligus rogercresseyi* (Boxshall & Bravo 2000; Bravo, Sevattal & Horsberg 2008).

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Short Communication

Use of Atlantic salmon, *Salmo salar* L., farm treatment data and bioassays to assess for resistance of sea lice, *Lepeophtheirus salmonis*, to emamectin benzoate (SLICE®) in British Columbia, Canada**S M Saksida¹, D Morrison², P McKenzie³, B Milligan⁴, E Downey¹, B Boyce² and A Eaves¹**¹ BC Centre for Aquatic Health Sciences, Campbell River, BC, Canada² Marine Harvest Canada, Campbell River, BC, Canada³ Mainstream Canada, Campbell River, BC, Canada⁴ Grieg Seafood BC, Campbell River, BC, Canada

Keywords: farmed salmon, sea lice, treatment efficacy.

Sea lice, *Lepeophtheirus salmonis* and some *Caligus* spp., are naturally occurring ectoparasites on wild salmon (Nagasawa 2001; Beamish *et al.* 2005) and have had the greatest economic impact of any parasite in salmonid fish farming globally (Johnson *et al.* 2004; Costello 2006). In contrast, there is clear evidence that these parasites are seldom a production or fish health concern on salmon farms in British Columbia (BC), Canada (Saksida *et al.* 2007). Nevertheless, due to concerns regarding the potential impact of sea lice originating from farmed Atlantic salmon, *Salmo salar* L., on wild Pacific salmon species in BC, their effective control continues to be a subject of considerable interest (Morton & Williams 2003; Marty, Saksida & Quinn 2010). In 2003, government regulatory authorities established requirements that farms maintain lice abundance below a threshold of three motile stage (adult and preadult stages) *L. salmonis* between March and June (Saksida *et al.* 2007). To meet these requirements, reduction of lice could be accomplished through harvesting or treatment. Macrocytic lactone types of

therapeutants have been almost exclusively used for the treatment of sea lice in BC; ivermectin that has been reported to have a low margin of safety to Atlantic salmon was used in the 1990's and then replaced by emamectin benzoate (EMB), (SLICE®; Merck Animal Health) when it became available in 1999 (Johnson *et al.* 1993; Palmer *et al.* 1996; Saksida *et al.* 2011). Consequently, SLICE® has been the only product used in the treatment of sea lice in BC for the last decade (Saksida *et al.* 2011).

A dependence on a single or limited number of therapeutants for sea lice has resulted in reports of reduced efficacy of products containing EMB in salmon farming regions other than BC (Bravo, Sevattal & Horsberg 2008; Lees *et al.* 2008; O'Donohoe *et al.* 2008; Igboeli *et al.* 2012). In this study, we evaluated whether sea lice resistance to EMB is also developing in BC. Two approaches were taken to examine for EMB resistance: (1) determine the effective dose (EC₅₀) in laboratory bioassays by exposing adult sea lice collected from farmed salmon to a range of EMB treatment concentrations *in vitro* and (2) examine sea lice and SLICE® treatment data collected from the same farms that were involved in the bioassay study and assess for change in treatment efficacy.

Sea lice (motile *L. salmonis* stages) were collected from farms located in five areas of the BC coast between 2010 and 2012. The collection was similar that described in Westcott *et al.* (2008). Sea water used in the bioassay was also collected at the farm.

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Jones, Simon

From: [REDACTED]
Sent: Thursday, October 12, 2017 8:53 AM
To: Jones, Simon
Subject: FW: Integrated Pest Management Workshop draft agenda
Attachments: Sea lice workshop agenda (draft 2) Oct 2 2017.docx

Follow Up Flag: Follow up
Flag Status: Flagged

Hi Simon,

[REDACTED] We just finished up with our AGM and summit in Victoria. It went really well. Very busy!

Did you have any final comments on this agenda for the IPM workshop? Giving some further thought to this, we were wondering if you would be willing to share moderation of the final session on next steps [REDACTED] We could work to flesh out the format for this part a little better. We have some time to do it well I think. It'd be great to pull your perspective and guidance in there.

Please let me know your thoughts on that,

Thanks again for your input, and help,

--

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From: [REDACTED]
Date: Wednesday, October 4, 2017 at 4:20 PM
To: [REDACTED] "Jones, Simon"
<Simon.Jones@dfo-mpo.gc.ca>, [REDACTED]
[REDACTED]
Subject: Integrated Pest Management Workshop draft agenda

Hi everyone:

Thanks for your contributions so far in planning this workshop. I've put your feedback into a revised agenda. Please find it attached for your review. [REDACTED] - you were going to provide me with a suggested speaker for the industry integrated pest management presentation (2nd on the list). Could you pass that name on please?

If the descriptions of each presentation are lacking info or not capturing what the presentation should be on, please edit. We'd like to have this finalized as soon as we can so that we can start inviting speakers.

s.19(1)

Thanks in advance,

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--

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**BC Salmon Farmers Association
Integrated Pest Management Workshop - DRAFT AGENDA v.2**

Day 1 – January 9, 2017 (tbc)			
Time	Topic	Speaker	Status
8:45a – 9:00a	Introductions + Outline	Moderator – <div></div> CAHS	
The Importance of Integrated Pest Management and What it Means			
9:00a – 9:30a	Integrated Pest Management	Craig Stephen, UBC Faculty of Medicine	
An overview of integrated pest management, and it’s applications in various agricultural settings, globally.			
9:30a – 10:00a	Integrated Pest Management in Action in the Salmon Farming Industry	To be provided	
10:00-10:15a	Break		
Time	Topic	Speaker	Status
Integrated Pest Management for Sea Lice in British Columbia			
10:15 – 10:45a	Sea lice management in British Columbia - Regulatory perspective	TBD, DFO	
An overview of how sea lice management is regulated for B.C. salmon farmers.			
10:45 – 11:15a	Sea lice management from the B.C. farming perspective	<div></div> Marine Harvest Canada	
An overview of practices implemented in taking steps towards an integrated pest management approach for sea lice on Marine Harvest Canada’s farms, and an overview of what’s needed to help improve the approach taken.			
11:15 – 11:45a	BC Sea Lice Monitoring Database	Crawford Revie, UPEI	
An overview of research and findings in the development of a novel historical database on sea lice on farm-raised and wild salmon in B.C.			
11:45 – 12:00p	Morning Speakers Panel Discussion and Questions		
12:00– 1:00p	Lunch		
IPM Tool Focus: Chemotherapeutants			
1:00-1:30p	Sea lice IPM – Chemotherapeutant usage, now and in the future	<div></div> Elanco	
Discussion on the use and importance of chemotherapeutants in an integrated pest management approach for sea lice on salmon farms, globally.			

**BC Salmon Farmers Association
Integrated Pest Management Workshop - DRAFT AGENDA v.2**

Time	Topic	Speaker	Status
1:30 – 2:00p	Slice Application and Sustainability in BC	<div></div> Merck	
An overview of permitting in Canada, application and environmental sustainability.			
2:00 – 2:30p	Salmosan Application and Sustainability in BC	<div></div> Fish Vet Group	
An overview of permitting in Canada, application and environmental sustainability.			
2:30 – 3:00p	H ₂ O ₂ Application and Sustainability in BC	<div></div> AquaPharma	
An overview of permitting in Canada, application and environmental sustainability.			
3:00 – 3:15p	Chemotherapeutant Speakers Panel Discussion and Questions		
3:15-3:30p	Break		
IPM Tool Focus: Green Technologies			
3:30-4:00p	Other Management Techniques in Practice (Norwegian perspective)	<div></div> Marine Harvest	
An overview of the non-chemical management practices implemented by Marine Harvest ASA to take an integrated approach to the management of sea lice on farms in Norway.			
4:00-4:30p	A B.C. example – cleaner fish research	<div></div> BC CAHS	
An overview of on-going research investigating the potential for local perch species as “cleaner fish” for the B.C. salmon farming industry.			
4:30– 5:00p	Green Technologies Discussion and Questions		
Day 2 – January 10, 2017			
Time	Topic	Speaker	Status
Research Tools to Assist an IPM Approach			
8:45-9:15a	Hydrographical Approach	Peter Chandler, DFO	
Review of how hydrographical modeling can inform practices of integrated pest management.			
9:15-9:45a	Epidemiological Approach	Sophie St. Hillaire, UPEI	
Review of how epidemiology can inform practices of integrated pest management.			
9:45-10:15a	Sea Lice Genomics	Ben Koop, UBC	
Discussion on the use of genomics in advising management practices for sea lice in B.C.			
10:15-10:30a	Research Tools Speaker Panel Discussion and Questions		

**BC Salmon Farmers Association
Integrated Pest Management Workshop - DRAFT AGENDA v.2**

10:30-10:45a	Break		
Advancing Integrated Pest Management in British Columbia			
10:45 – 12:15p	Moderated Panel Discussion		

s.19(1)

Keith, Ian

From: Keith, Ian
Sent: October-12-17 9:42 AM
To: Waddington, Zac
Subject: bioassay not predictive for baths
Attachments: in the field bioassay for sensitivity testing.pdf

This author is the Norway pharmacology authority. Their EMB bioassay they don't make claims for because they ended their assessment of viability at 2 weeks which was too soon (and hence my insistence that I can't interpret lice counts till 21 days after SLICE treatment).

Dr. Ian Keith DVM
Field Operations Veterinarian - Pacific Region
Fisheries and Oceans Canada | Pêches et Océans Canada
Fisheries Management
Aquaculture Management Division | Gestion de l'aquaculture
Aquaculture Environmental Operations - Fish Health
#103 - 2435 Mansfield Drive
Courtenay, British Columbia V9N 2M2
Telephone | Téléphone: 250-703-0917
Mobile | Portable: [REDACTED]
Fax | Télécopieur: 250-703-0921
Ian.Keith@dfo-mpo.gc.ca

s.16(2)(c)

Available at <https://onlinelibrary.wiley.com/doi/epdf/10.1111/jfd.12053>

Single-dose field bioassay for sensitivity testing in sea lice, *Lepeophtheirus salmonis*: development of a rapid diagnostic tool

K O Helgesen and T E Horsberg

Department of Pharmacology and Toxicology, Norwegian School of Veterinary Science, Oslo, Norway

Abstract

Sea lice on farmed salmonids are often treated with chemicals. Sensitivity testing of sea lice can reduce the number of treatments by identifying substances the sea lice are susceptible to. This study describes a simpler protocol for field sensitivity testing than today's six-dose bioassay. The protocol, which uses a single dose of the delousing agents deltamethrin, azamethiphos and emamectin benzoate, was developed on four different strains of sea lice and their subsequent generations. A sensitive strain and a strain showing reduced sensitivity were identified for each chemical after performing traditional bioassays and small-scale treatments. The single doses for each chemical were established by modelling dose–response curves from 24-h bioassays on strains with differences in sensitivity. The largest difference between the lower 80% prediction interval for the sensitive strain and the upper 80% prediction interval for the strain showing reduced sensitivity was identified for each delousing agent. The concentration of the chemical and the % mortality corresponding to each of the 80% prediction intervals were subsequently established. To validate the protocol for field use, further studies on both sensitive and resistant strains of sea lice under field conditions are required.

Keywords: bioassay, *Lepeophtheirus salmonis*, resistance, sea lice, sensitivity testing, single dose.

Introduction

Sea lice (Crustacea: Copepoda), infecting farmed salmonids, is a problem in many salmonid-producing countries. *Lepeophtheirus salmonis* (Krøyer) is the species which most commonly infects farmed salmonids in the Northern Hemisphere (as reviewed in Pike & Wadsworth 2000), while *Caligus rogercresseyi* (Boxhall & Bravo) is the most common copepod found on farmed salmonids in Chile (Carvajal, Gonzalez & George-Nascimento 1998; Boxshall & Bravo 2000; Bravo 2003). The sea lice cause stress, skin damage and osmoregulation problems (Grimnes & Jakobsen 1996; Bowers *et al.* 2000; Finstad *et al.* 2000), and the infected farmed salmonids represent a sea lice reservoir for wild salmonids (as reviewed by Costello 2009a). Different strategies have been chosen to combat sea lice, with chemical therapy being one of them. Several chemicals have been or are currently being used to combat sea lice (Grant 2002; Grave *et al.* 2004). Chemical treatment is a stressful experience for the fish (Bowers, Speare & Burka 2002), a potential threat for the surrounding wild life (as reviewed in Burrige *et al.* 2010), in addition to being an economical cost (Costello 2009b). Furthermore, chemical treatment may select for resistant parasites, thereby leaving the most resistant to form the next generation (Murray 2011).

Resistance to chemotherapeutants in sea lice has been reported from several countries in the recent years. In Scotland in 1992, for instance, Jones *et al.* reported on dichlorvos-resistant sea lice. These findings were based on bioassays initiated in sites with reduced treatment efficacy (Jones, Sommerville & Wootten 1992). An increase in

Correspondence K O Helgesen, Department of Pharmacology and Toxicology, Norwegian School of Veterinary Science, PO box 8146 Dep, N-0033 Oslo, Norway
(e-mail: kari.helgesen@nvh.no)

**Pages 371 to / à 381
are withheld pursuant to section
sont retenues en vertu de l'article**

68(a)

**of the Access to Information Act
de la Loi sur l'accès à l'information**

Paylor, Adrienne

From: Paylor, Adrienne
Sent: October-12-17 4:46 PM
To: McCorquodale, Brenda
Subject: FW: letter re: SLICE to Grieg
Attachments: FW: Urgent - respond to Grieg transfer; oct Grieg SLICE treatments Option 1.docx; Ian's vet to vet letter send to Greig; oct Grieg SLICE treatments Option 1.docx

Brenda I'm losing track of what you have been copied on regarding the Grieg Gore and Slice discussions and correspondence. I believe you were on the calls but not sure what emails you may have from other sources. Anyway the first attachment is what Grieg sent us as reassurance to the Gore transfer and then based on Ian talking to [REDACTED] (Grieg's vet) Ian became concerned they would not use alternative methods to slice so we drafted the next two letters as options but neither were sent out. I told Ian to send [REDACTED] an email identifying his concerns with slice and what he wanted to see in the SOP's that are due tomorrow but he sent it as a letter in the last attachment. So now you have all the pieces to the puzzle so please call if our 5 min elevator debrief needs more explaining.

Thx Adrienne

From: Paylor, Adrienne
Sent: Thursday, October 05, 2017 4:38 PM
To: Jackson, Corey
Cc: Keith, Ian; Knight, Joe; Waddington, Zac
Subject: letter re: SLICE to Grieg

Hi Corey

As per our phone conversation and the message I just left you, attached are 2 draft letters to Grieg indicating our concern with Slice use in Nootka. I've also attached the past correspondence that I have on file regarding this issue that has already been sent to Grieg for context and continuity. Option 1 is veterinarian to veterinarian correspondence. [REDACTED]

[REDACTED] So option 2 is director to CEO correspondence [REDACTED]

[REDACTED] I am cc'ing Joe Knight here to keep him in the loop and ensure it captures the conversation today but we'll clearly need to discuss this further as a group.

If we decide to send one of these letters, it would need to go out before October 15 which is the deadline referred to for SOP submission in our CoL.

Once you have had a chance to review we can set up a time to discuss.

Thanks,
Adrienne

s.19(1)

s.21(1)(b)

Pages 383 to / à 389
are not relevant
sont non pertinentes

**Pages 390 to / à 391
are duplicates of
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pages 284 to / à 285**

Page 392
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page 281

**Pages 393 to / à 394
are duplicates of
sont des duplicatas des
pages 275 to / à 276**

**Pages 395 to / à 396
are duplicates of
sont des duplicatas de la
page 283**

Paylor, Adrienne

From: Paylor, Adrienne
Sent: October-12-17 5:19 PM
To: McCorquodale, Brenda
Subject: Fw: letter re: SLICE to Grieg
Attachments: oct Grieg SLICE treatments Option 2.docx

Sorry Brenda for some reason option 2 does not attach properly. Please add this to the full package I just sent you and apologies for the confusion on what you have been copied on. Again these formal options have not been sent as we ran out of time to debrief as a management team. In the meantime Ian Sent his email because he wanted it to go out before the new SOP's were due this week on Oct 15 according to CoL.

A

Sent from my BlackBerry 10 smartphone on the Rogers network.

From: Paylor, Adrienne <Adrienne.Paylor@dfo-mpo.gc.ca>
Sent: Thursday, October 5, 2017 4:54 PM
To: Jackson, Corey
Cc: Keith, Ian; Knight, Joe; Waddington, Zac
Subject: RE: letter re: SLICE to Grieg

Sorry Option 2 letter didn't attach correctly so sending here

From: Paylor, Adrienne
Sent: Thursday, October 05, 2017 4:38 PM
To: Jackson, Corey
Cc: Keith, Ian; Knight, Joe; Waddington, Zac
Subject: letter re: SLICE to Grieg

Hi Corey

As per our phone conversation and the message I just left you, attached are 2 draft letters to Grieg indicating our concern with Slice use in Nootka. I've also attached the past correspondence that I have on file regarding this issue that has already been sent to Grieg for context and continuity. Option 1 is veterinarian to veterinarian correspondence. [REDACTED]

[REDACTED] So option 2 is director to CEO correspondence [REDACTED]

[REDACTED] I am cc'ing Joe Knight here to keep him in the loop and ensure it captures the conversation today but we'll clearly need to discuss this further as a group.

If we decide to send one of these letters, it would need to go out before October 15 which is the deadline referred to for SOP submission in our CoL.

Once you have had a chance to review we can set up a time to discuss.

Thanks,
Adrienne

s.21(1)(b)

**Pages 398 to / à 399
are duplicates of
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pages 256 to / à 257**

Paylor, Adrienne

From: Paylor, Adrienne
Sent: October-20-17 12:44 PM
To: Waddington, Zac
Subject: Fw: SOPs for 2.4
Attachments: The-genetics-and-genomics-of-insecticide-resistance_2004_Trends-in-Genetics.pdf; Oct 2017 [REDACTED] re sept 25 call.doc

So are we good?

Sent from my BlackBerry 10 smartphone on the Rogers network.

From: Keith, Ian <Ian.Keith@dfo-mpo.gc.ca>
Sent: Friday, October 20, 2017 12:05 PM
To: [REDACTED]
Cc: Waddington, Zac; Paylor, Adrienne
Subject: FW: SOPs for 2.4

Hi [REDACTED]

Thanks for the meeting this morning and sharing abundance/bioassay data from the Nootka farms, and the report that the wellboat is operational for hydrogen peroxide treatment and is currently in use at the Nootka farms other than Gore. With this hydrogen peroxide contingency for lice management at Gore, the basis of the transfer permit requirement has been met in principle, lice recovery challenges notwithstanding.

With the SLICE bioassay data you have already shared, the predictability of efficacy at Gore is dependent on accurate dosing, as discussed. The challenge to avoid subtherapeutic dosing with size variation at Gore had some mitigation with [REDACTED] the performance of the new feeding system to mitigate against feeding indominance within the population is as yet untested however. This purported improvement in feeding and discussions with peers is expected to bring improvement from the subtherapeutic dosing seen in Esperanza Inlet in 2016.

Details of the population mixes were not shared over the call, but the expectation is that each mix would be considered a separate population with which to determine confidence in dosing accuracy. Readiness with peroxide treatment would be determined by tissue analyses and would be your proxy for treatment failure with peroxide treatment as the action, again, as satisfying the understanding of the transfer permit for Gore and situation under which you would use SLICE at Gore, or elsewhere in Nootka.

I'll be back at work next week to review the SOP and for further discussion if desired, and please keep us abreast of the situation.

Thank you.

Kind regards,

Ian

From: Keith, Ian
Sent: October 9, 2017 2:35 AM
To: [REDACTED]
Cc: Paylor, Adrienne
Subject: SOPs for 2.4

s.19(1)

s.20(1)(b)

s.21(1)(b)

Hi [REDACTED]

Please see the attached. I will be in the office Tuesday should you wish to discuss.

Regards,

Ian

**Pages 401 to / à 408
are duplicates of
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pages 267 to / à 274**

Paylor, Adrienne

From: Paylor, Adrienne
Sent: October-20-17 12:51 PM
To: Jackson, Corey; Lavigne, Lauren; McCorquodale, Brenda
Subject: Fw: SOPs for 2.4

FYI looks like the Nootka Grieg slice issue is resolved.

A

Sent from my BlackBerry 10 smartphone on the Rogers network.

From: Waddington, Zac <Zac.Waddington@dfo-mpo.gc.ca>
Sent: Friday, October 20, 2017 12:45 PM
To: Paylor, Adrienne
Subject: RE: SOPs for 2.4

All good. It was a good chat, [REDACTED]
[REDACTED]

Zac

From: Paylor, Adrienne
Sent: Friday, October 20, 2017 12:44 PM
To: Waddington, Zac
Subject: Fw: SOPs for 2.4

So are we good?

s.19(1)

Sent from my BlackBerry 10 smartphone on the Rogers network.

s.20(1)(b)

From: Keith, Ian <Ian.Keith@dfo-mpo.gc.ca>
Sent: Friday, October 20, 2017 12:05 PM
To: [REDACTED]
Cc: Waddington, Zac; Paylor, Adrienne
Subject: FW: SOPs for 2.4

s.21(1)(b)

Hi [REDACTED]

Thanks for the meeting this morning and sharing abundance/bioassay data from the Nootka farms, and the report that the wellboat is operational for hydrogen peroxide treatment and is currently in use at the Nootka farms other than Gore. With this hydrogen peroxide contingency for lice management at Gore, the basis of the transfer permit requirement has been met in principle, lice recovery challenges notwithstanding.

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I'll be back at work next week to review the SOP and for further discussion if desired, and please keep us abreast of the situation.

Thank you.

Kind regards,

Ian

From: Keith, Ian

Sent: October 9, 2017 2:35 AM

To: [REDACTED]

Cc: Paylor, Adrienne

Subject: SOPs for 2.4

Hi [REDACTED]

Please see the attached. I will be in the office Tuesday should you wish to discuss.

Regards,

Ian

s.19(1)

Paylor, Adrienne

From: Paylor, Adrienne
Sent: October-20-17 12:51 PM
To: Waddington, Zac
Subject: Re: SOPs for 2.4

Awesome thanks :)

Sent from my BlackBerry 10 smartphone on the Rogers network.

From: Waddington, Zac
Sent: Friday, October 20, 2017 12:45 PM
To: Paylor, Adrienne
Subject: RE: SOPs for 2.4

All good. It was a good chat, [REDACTED]
[REDACTED]

Zac

From: Paylor, Adrienne
Sent: Friday, October 20, 2017 12:44 PM
To: Waddington, Zac
Subject: Fw: SOPs for 2.4

So are we good?

s.19(1)

s.20(1)(b)

s.21(1)(b)

Sent from my BlackBerry 10 smartphone on the Rogers network.

From: Keith, Ian <Ian.Keith@dfo-mpo.gc.ca>
Sent: Friday, October 20, 2017 12:05 PM
To: [REDACTED]
Cc: Waddington, Zac; Paylor, Adrienne
Subject: FW: SOPs for 2.4

[REDACTED]
Thanks for the meeting this morning and sharing abundance/bioassay data from the Nootka farms, and the report that the wellboat is operational for hydrogen peroxide treatment and is currently in use at the Nootka farms other than Gore. With this hydrogen peroxide contingency for lice management at Gore, the basis of the transfer permit requirement has been met in principle, lice recovery challenges notwithstanding.

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Details of the population mixes were not shared over the call, but the expectation is that each mix would be considered a separate population with which to determine confidence in dosing accuracy. Readiness with peroxide treatment would be determined by tissue analyses and would be your proxy for treatment failure with peroxide treatment as the action, again, as satisfying the understanding of the transfer permit for Gore and situation under which you would use SLICE at Gore, or elsewhere in Nootka.

I'll be back at work next week to review the SOP and for further discussion if desired, and please keep us abreast of the situation.

Thank you.

Kind regards,

Ian

From: Keith, Ian

Sent: October 9, 2017 2:35 AM

To: [REDACTED]

Cc: Paylor, Adrienne

Subject: SOPs for 2.4

[REDACTED]
Please see the attached. I will be in the office Tuesday should you wish to discuss.

Regards,

Ian

s.19(1)

Jones, Simon

From: [REDACTED]
Sent: Monday, October 30, 2017 4:00 PM
To: [REDACTED] Jones, Simon; [REDACTED]
Subject: Integrated Pest Management Workshop planning questions
Attachments: IPM workshop agenda (draft 3) Oct 2 2017[1].docx

Follow Up Flag: Follow up
Flag Status: Flagged





Just a few updates for you on IPM workshop planning – and looking for some help:

- I've heard back from Merck via [REDACTED] that [REDACTED] (proposed in place [REDACTED]) won't be available to speak on Slice for the dates we are proposing for the IPM workshop. (Jan 10-11) but they could make the next week (January 15). Would moving the workshop to the week of Jan 15 be a problem for anyone's schedules?
- Ben Koop is not available at all between Jan 9 and 27. Is this a problem to our agenda?
- I have not heard back [REDACTED] Is there someone else at Marine Harvest that I should contact in reaching him?

Thank you everyone,

s.19(1)

**BC Salmon Farmers Association
Integrated Pest Management Workshop - DRAFT AGENDA v.2**

Day 1 – January 10, 2017 (tbc)			
Time	Topic	Speaker	Status
8:45a – 9:00a	Introductions + Outline	Moderator –   CAHS	
The Importance of Integrated Pest Management and What it Means			
9:00a – 9:30a	Integrated Pest Management	TBD	
An overview of integrated pest management, and it’s applications in various agricultural settings, globally.			
9:30a – 10:00a	Integrated Pest Management in Action in the Salmon Farming Industry	To be provided	
10:00-10:15a	Break		
Time	Topic	Speaker	Status
Integrated Pest Management for Sea Lice in British Columbia			
10:15 – 10:45a	Sea lice management in British Columbia - Regulatory perspective	TBD, DFO	
An overview of how sea lice management is regulated for B.C. salmon farmers.			
10:45 – 11:15a	Sea lice management from the B.C. farming perspective	 Marine Harvest Canada	
An overview of practices implemented in taking steps towards an integrated pest management approach for sea lice on Marine Harvest Canada’s farms, and an overview of what’s needed to help improve the approach taken.			
11:15 – 11:45a	BC Sea Lice Monitoring Database	Crawford Revie, UPEI	
An overview of research and findings in the development of a novel historical database on sea lice on farm-raised and wild salmon in B.C.			
11:45 – 12:00p	Morning Speakers Panel Discussion and Questions		
12:00– 1:00p	Lunch		
IPM Tool Focus: Chemotherapeutants			
1:00-1:30p	Sea lice IPM – Chemotherapeutant usage, now and in the future	 Elanco	
Discussion on the use and importance of chemotherapeutants in an integrated pest management approach for sea lice on salmon farms, globally.			
Time	Topic	Speaker	Status

**BC Salmon Farmers Association
Integrated Pest Management Workshop - DRAFT AGENDA v.2**

1:30 – 2:00p	Slice Application and Sustainability in BC		Merck
An overview of permitting in Canada, application and environmental sustainability.			
2:00 – 2:30p	Salmosan Application and Sustainability in BC		Fish Vet Group
An overview of permitting in Canada, application and environmental sustainability.			
2:30 – 3:00p	H ₂ O ₂ Application and Sustainability in BC		AquaPharma
An overview of permitting in Canada, application and environmental sustainability.			
3:00 – 3:15p	Chemotherapeutant Speakers Panel Discussion and Questions		
3:15-3:30p	Break		
IPM Tool Focus: Green Technologies			
3:30-4:00p	Other Management Techniques in Practice (Norwegian perspective)		Marine Harvest
An overview of the non-chemical management practices implemented by Marine Harvest ASA to take an integrated approach to the management of sea lice on farms in Norway.			
4:00-4:30p	A B.C. example – cleaner fish research		BC CAHS
An overview of on-going research investigating the potential for local perch species as “cleaner fish” for the B.C. salmon farming industry.			
4:30– 5:00p	Green Technologies Discussion and Questions		
Day 2 – January 11, 2017			
Time	Topic	Speaker	Status
Research Tools to Assist an IPM Approach			
8:45-9:15a	Hydrographical Approach	Peter Chandler, DFO	
Review of how hydrographical modeling can inform practices of integrated pest management.			
9:15-9:45a	Epidemiological Approach	Sophie St. Hillaire, UPEI	
Review of how epidemiology can inform practices of integrated pest management.			
9:45-10:15a	Sea Lice Genomics	Ben Koop, UBC	
Discussion on the use of genomics in advising management practices for sea lice in B.C.			
10:15-10:30a	Research Tools Speaker Panel Discussion and Questions		
10:30-10:45a	Break		

**BC Salmon Farmers Association
Integrated Pest Management Workshop - DRAFT AGENDA v.2**

Advancing Integrated Pest Management in British Columbia			
10:45 – 12:15p	Moderated Panel Discussion	[REDACTED] and Simon Jones, DFO	

s.19(1)

Sandberg, Krista

From: Sandberg, Krista
Sent: October-31-17 1:02 PM
To: Waddington, Zac
Subject: RE: Lice reporting question

Just a couple quick comments:

- Monthly abundance reports are submitted and administrative compliance is tracked. The Department reviews these reports and ensures that exceedance events are followed up with appropriate management action.
- Industry reports all sea lice management (Slice, Hydrogen Peroxide, Harvesting) in their monthly sea lice reports and the Department follows up/works with industry to ensure that actions are efficient and effective.
- We are working on our capacity to monitor and enforce administrative compliance with regards to 3 day exceedance notifications – are they being submitted and are they on time?

Krista Sandberg

Cellular | Cellulaire
Office | Bureau 250-286-5835



Government
of Canada

Gouvernement
du Canada

Canada

From: Waddington, Zac
Sent: Tuesday, October 31, 2017 12:46 PM
To: Sandberg, Krista
Subject: Lice reporting question

Sorry to add to what I'm sure is an already hectic day. But with regards to this question, do we have any statistics available that might be satisfactory?

14	<p>Please expand the information provided on how DFO regulates sea lice levels on farmed salmon. What are the relevant conditions of licence; how is compliance monitored and the conditions of licence enforced (i.e. timely management actions taken to come back into compliance)? Please provide statistics on monitoring done for sea lice treatment, including time to return to compliance with relevant conditions of licence.</p>	<p>AEO - sea lice monitoring/management The COL dictating thresholds for action and reporting requirements can be found at: http://www.pac.dfo-mpo.gc.ca/aquaculture/licence-permis/docs/licence-cond-permis-mar/licence-cond-permis-mar-eng.pdf</p> <p>DFO audits a minimum of one farm in each of the seven fish health zones each quarter. During the outmigration period (April-June) we audit 50% of all active sites in BC. During an audit we monitor the methodology and classification of lice life-stage performed by farm staff on 30 fish from 3 different pens (10 fish per pen). We then perform our own independent count and categorization of lice on 30 fish (10 fish from each of the same pens as the industry count). The level of agreement between our counts is tested using a t-test. At $p < 0.05$ we deem our counts to be disparate and the industry is notified and further training of farm staff must occur.</p> <p>Currently the time for industry to bring their lice numbers back into compliance is not codified in the COL. We will be looking to</p>
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s.16(2)(c)

		change this in our next licence issuance. Industry does report lice counts following treatment on a quarterly basis.
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My very rough comments are in the box on the right, his question(s) are on the left.

Dr. Zac Waddington DVM, B.Env.Sc (Hons)
Lead Veterinarian - Pacific Region
Fisheries and Oceans Canada | **Pêches et Océans Canada**
Aquaculture Environmental Operations - Fish Health
Courtenay, British Columbia V9N 2M2
Telephone | Téléphone: 250-703-0902
Fax | Télécopieur: 250-703-0921
Zac.Waddington@dfo-mpo.gc.ca

Manchester, Howie

From: Keith, Ian
Sent: November-08-17 11:10 AM
To: Manchester, Howie
Subject: FW: SOPs for 2.4

This communication compels Grieg to run tissue level tests on each population post SLICE treatment, and this is a proxy for treatment efficacy. They were not compelled to submit these to the department but it is appropriate to ask for detail of SLICE treatment at the site. (I don't expect that the test results would be at the site but you could ask.)

Dr. Ian Keith DVM
Field Operations Veterinarian - Pacific Region
Fisheries and Oceans Canada | Pêches et Océans Canada
Fisheries Management
Aquaculture Management Division | Gestion de l'aquaculture
Aquaculture Environmental Operations - Fish Health
#103 - 2435 Mansfield Drive
Courtenay, British Columbia V9N 2M2
Telephone | Téléphone: 250-703-0917
Mobile | Portable: [REDACTED]
Fax | Télécopieur: 250-703-0921
Ian.Keith@dfo-mpo.gc.ca

From: Keith, Ian
Sent: Friday, October 20, 2017 12:05 PM
To: [REDACTED]
Cc: Waddington, Zac; Paylor, Adrienne
Subject: FW: SOPs for 2.4

Hi [REDACTED]

Thanks for the meeting this morning and sharing abundance/bioassay data from the Nootka farms, and the report that the wellboat is operational for hydrogen peroxide treatment and is currently in use at the Nootka farms other than Gore. With this hydrogen peroxide contingency for lice management at Gore, the basis of the transfer permit requirement has been met in principle, lice recovery challenges notwithstanding.

With the SLICE bioassay data you have already shared, the predictability of efficacy at Gore is dependent on accurate dosing, as discussed. The challenge to avoid subtherapeutic dosing with size variation at Gore had some mitigation with [REDACTED] the performance of the new feeding system to mitigate against feeding indominance within the population is as yet untested however. This purported improvement in feeding and discussions with peers is expected to bring improvement from the subtherapeutic dosing seen in Esperanza Inlet in 2016. Details of the population mixes were not shared over the call, but the expectation is that each mix would be considered a separate population with which to determine confidence in dosing accuracy. Readiness with peroxide treatment would be determined by tissue analyses and would be your proxy for treatment failure with peroxide treatment as the action, again, as satisfying the understanding of the transfer permit for Gore and situation under which you would use SLICE at Gore, or elsewhere in Nootka.

I'll be back at work next week to review the SOP and for further discussion if desired, and please keep us abreast of the situation.

Thank you.
Kind regards,
Ian

s.16(2)(c)

s.19(1)

s.20(1)(b)

From: Keith, Ian
Sent: October 9, 2017 2:35 AM
To: [REDACTED]
Cc: Paylor, Adrienne
Subject: SOPs for 2.4

Hi [REDACTED]

Please see the attached. I will be in the office Tuesday should you wish to discuss.

Regards,
Ian

s.19(1)

Jones, Simon

From: [REDACTED]
Sent: Friday, November 10, 2017 4:09 PM
To: Taylor, Nathan; Jones, Simon
Subject: Integrated Pest Management workshop planning
Attachments: IPM workshop agenda (draft 6) Nov 9 2017.docx

Follow Up Flag: Follow up
Flag Status: Flagged

Hi Nathan and Simon,

As we're planning for a workshop on integrated pest management of sea lice, to be held in early January, I wanted to ask who from DFO Science we should be inviting? I've attached a draft agenda.

So far on our invite list we have the following, plus Stewart Johnson. Peter Chandler is not available. Is there anyone else who might be interested? We're planning on getting invites out next week.

DFO	Jay	Parsons
DFO	Simon	Jones
DFO	Ingrid	Burgetz
DFO	Ian	Keith
DFO	Zach	Waddington
DFO	Christine	MacWilliams
DFO	Mark	Higgins
DFO	Nathan	Taylor
DFO	Mike	Foreman

Thank you in advance,
[REDACTED]

--

[REDACTED]
BC Salmon Farmers Association

Office: (250) 286-1636 x [REDACTED]

Mobile: [REDACTED]

[REDACTED]
BCSalmonfarmers.ca

s.19(1)

**BC Salmon Farmers Association
Integrated Pest Management Workshop - DRAFT AGENDA v.4**

Day 1 – January 10, 2017		
Time	Topic	Speaker
8:30a – 8:40a	Introductions + Outline	Moderator – [REDACTED] CAHS
The Importance of Integrated Pest Management and What it Means		
8:40 – 9:25a	Integrated Pest Management	TBD – awaiting input from Pharmaq/ Cargill on a speaker
An overview of integrated pest management, and it's applications in various agricultural settings, globally.		
9:25a – 10:10a	Integrated Pest Management in Action in the Salmon Farming Industry	Kari Helgeson, Norwegian Veterinary Institute
An overview of integrated pest management in the Norwegian salmon farming industry.		
10:10-10:25a	Break	
Integrated Pest Management for Sea Lice in British Columbia		
10:25 – 10:50a	Sea lice management in British Columbia - Regulatory perspective	DFO TBD
An overview of how sea lice management is regulated for B.C. salmon farmers.		
10:50 - 11:35a	Sea lice management from the B.C. farming perspective	[REDACTED] Marine Harvest Canada
An overview of practices implemented in taking steps towards an integrated pest management approach for sea lice on Marine Harvest Canada's farms, and an overview of what's needed to help improve the approach taken.		
11:35 – 12:20p	BC Sea Lice Monitoring Database	Crawford Revie, UPEI
An overview of research and findings in the development of a novel historical database on sea lice on farm-raised and wild salmon in B.C.		
12:20 – 1:20p	Lunch	
IPM Tool Focus: Chemotherapeutants		
1:20 - 2:05p	Sea lice IPM – Chemotherapeutant usage, now and in the future	Kari Helgeson, Norwegian Veterinary Institute
Discussion on the use and importance of chemotherapeutants in an integrated pest management approach for sea lice on salmon farms, globally.		
2:05 – 2:50p	Slice Application and Sustainability in BC	[REDACTED] Merck
An overview of permitting in Canada, application and environmental sustainability.		

s.19(1)

**BC Salmon Farmers Association
Integrated Pest Management Workshop - DRAFT AGENDA v.4**

Time	Topic	Speaker
2:50 - 3:05p	Break	
3:05 – 3:50p	Salmosan Application and Sustainability in BC	Fish Vet Group
An overview of permitting in Canada, application and environmental sustainability.		
3:50 – 4:45p	H ₂ O ₂ Application and Sustainability in BC	AquaPharma
An overview of permitting in Canada, application and environmental sustainability.		
4:45 – 5:00p	Day 1 Wrap Up	BC CAHS
Day 2 – January 11, 2017		
IPM Tool Focus: Green Technologies		
8:30-9:15a	Other Management Techniques in Practice (Norwegian perspective)	Marine Harvest
An overview of the non-chemical management practices implemented by Marine Harvest ASA to take an integrated approach to the management of sea lice on farms in Norway.		
9:15-9:45a	A B.C. example – cleaner fish research	BC CAHS
An overview of on-going research investigating the potential for local perch species as “cleaner fish” for the B.C. salmon farming industry.		
9:45-10:00a	Break	
Research Tools to Assist an IPM Approach		
10:00-10:30a	Hydrographical Approach	DFO – Mike Foreman providing a name
Review of how hydrographical modeling can inform practices of integrated pest management.		
10:30 – 11:00a	Epidemiological Approach	Sophie St. Hillaire, UPEI
Review of how epidemiology can inform practices of integrated pest management.		
11:00-11:30a	Sea Lice Genomics	TBD
Discussion on the use of genomics in advising management practices for sea lice.		
Advancing Integrated Pest Management in British Columbia		
11:30 – 1:00p	Moderated Panel Discussion, working lunch	and Simon Jones, DFO

Manchester, Howie

From: Manchester, Howie
Sent: November-17-17 2:34 PM
To: 'Charbonneau, Michelle'; 'Stenhouse, Shawn'
Cc: 'Waddington, Zac'; 'Drinkwater, Alisha'; 'Keith, Ian'
Subject: Questions regarding SL overthreshold outside outmigration

Shawn & Michelle,

Just a quick response to your SL question yesterday.

- Yes, sites do have to report over threshold outside outmigration but report during routine monthly sampling reports not within 7 days.
- Yes, this site did report this in their August 2017 report. Since the audit was done on August 29, this report was not available until September 15th.
- At this point the site needs to go to at least once every two weeks. Which they did.
- Yes, this site needed to indicate what their plan was to deal with the exceedance within 30 days. But after talking with Ian , it is unclear where this plan goes, Ian does receive plans from Grieg and MHC in the FH AQFF email, but not Cermaq, apparently they are under the understanding that this should go in the monthly report under the 'Action Taken' section (does not make sense). Ian say's he will clarify this with Cermaq and get them to report as the other sites. Regardless, Millar's plan was to do a SLICE after their September 2 sampling but were not able to carry this out until September 21 due to environmental conditions.

Hope this clarifies some of your questions.

Thanks

Howie

Jones, Simon

From: Jordan Poley [REDACTED]
Sent: Thursday, December 7, 2017 8:46 AM
To: Jones, Simon
Subject: Re: Sussie's question and Azamethiphos

Follow Up Flag: Follow up
Flag Status: Flagged

Hi Simon

That all sounds good. Thank you!

Jordan

On Thu, Dec 7, 2017 at 12:25 PM Jones, Simon <Simon.Jones@dfo-mpo.gc.ca> wrote:

Hi Jordan,

As I recall the larval cultures used for ISH were primarily nauplii but did include some copepodids. The image however, shows a nauplius larva.

Yes, I am interested in participating in discussions of an azamethiphos bio-assay with Pacific lice. Will have more time early in New Year.

Cheers,

Simon

From: Jordan Poley [REDACTED]
Sent: December-07-17 4:39 AM
To: Jones, Simon
Subject: Sussie's question and Azamethiphos

s.19(1)

Hi Simon

I hope you're doing well! I have a couple of quick questions for you, but no rush in getting back to me on these!

I just got a question from Sussie Dalvin about our microsporidian paper. She is wondering if the lice we used for ISH were nauplii or copepodid. It says nauplii in the figure legend, but the statement "ISH-positive reactions were also visualised within unidentified tissues of larval copepods" is hanging her up. I think she may be getting mixed up on the difference between copepod and copepodid. Anyway, I just wanted to confirm again that these were nauplii II staged lice in the ISH experiment.

Secondly, I was wondering if you'd be interested in joining in on a project with me and Kiranpreet Kaur from Tor Horsberg's lab. She has been scanning lice collected in Canada (Atlantic and Pacific) for the SNP involved in azamethiphos resistance. Given the unique situation in Pacific lice (i.e. no resistance), we thought it might be nice to represent this subspecies in our work. We have a Pacific lice collection (~50 individuals) from 2014 that is currently being assayed for SNP identification and we're looking to add a bit more to the project on the Pacific end. As Kiran reported earlier this year in her Scientific Reports paper, the SNP conferring azamethiphos resistance was around before the use of organophosphates in salmon aquaculture. We think it would be interesting to survey the Pacific and report on the proportion of lice with this SNP. We'd also like to assess their sensitivity (EC_{50} ideally) and gene expression responses (qPCR; cytochrome p450s) to treatment.

We are wondering if you'd be interested in running an azamethiphos bioassay with pre-adult or adult Pacific lice where sex and treatment (hopefully multiple concentrations of azamethiphos and an ethanol control) would be completed. The qPCR and SNP identification would be done in Norway (and maybe PEI). If this is of interest, please let me know and we could discuss details a bit further.

All the best,

Jordan

--

Jordan D. Poley

PhD candidate

Atlantic Veterinary College, UPEI

Pathology & Microbiology - Hoplite lab

550 University Ave, Charlottetown

PEI, C1A4P3

Canada

--

Jordan D. Poley

PhD candidate

Atlantic Veterinary College, UPEI

Pathology & Microbiology - Hoplite lab

550 University Ave, Charlottetown

PEI, C1A4P3

Canada

No information has been removed or severed from this page

Jones, Simon

From: [REDACTED] <admin@cahs-bc.ca>
Sent: Friday, January 5, 2018 9:33 AM
To: [REDACTED] 'Crawford Revie'; [REDACTED]; Jones, Simon; [REDACTED] 'Sophie St Hilaire (ssthilaire@upei.ca)'; [REDACTED]
[REDACTED]
[REDACTED] Bianucci, Laura; Wan, Di; [REDACTED] - Cargill Innovation ([REDACTED]); Jackson, Corey; 'Kari Helgesen - Norwegian Veterinary Institute (Kari.helgesen@vetinst.no)'; [REDACTED]
Cc: [REDACTED]
Subject: RE: IPM Workshop preparations for Speakers
Attachments: Final Workshop agenda V3.pdf
Importance: High
Categories: Yellow Category

Good morning

Attached is the agenda to be handed out at the workshop next week. Please note that the Reception at the Riptide Marine Pub is on **Wednesday**, Jan 10th from 6 – 9 pm.

Should you have any questions or concerns, please let me know. As well, should you require pick up from the airport (on the 9th or 10th), please let me know so that we can arrange a ride for you.

Finally, if you have travel expenses that will need to be reimbursed by the BCSFA, please save your receipts and submit to me (scanned copies are fine) by Friday, Jan 19, 2018.

We look forward to meeting with you all next week.

Best regards,

[REDACTED]

From: [REDACTED]
Sent: Monday, December 18, 2017 1:51 PM
To: [REDACTED] 'Crawford Revie ([REDACTED])'; 'Simon Jones (Simon.Jones@dfo-mpo.gc.ca)'; [REDACTED] 'Sophie St Hilaire (ssthilaire@upei.ca)'; [REDACTED]
[REDACTED] 'Laura Bianucci (Laura.Bianucci@dfo-mpo.gc.ca)'; 'Di Wan (Di.Wan@dfo-mpo.gc.ca)'; [REDACTED] - Cargill Innovation [REDACTED]; 'Corey Jackson (Corey.Jackson@dfo-mpo.gc.ca)'; 'Kari Helgesen - Norwegian Veterinary Institute (Kari.helgesen@vetinst.no)'; [REDACTED]
Cc: [REDACTED]

s.19(1)

Subject: IPM Workshop preparations for Speakers

Importance: High

Good Afternoon Integrated Pest Management Workshop Speakers,

The BC Centre for Aquatic Health Sciences is providing support to the BC Salmon Farmers Association (BCSFA) in the development and implementation of the upcoming workshop on Integrated Pest Management, at the Maritime Heritage Centre in Campbell River on January 10 & 11, 2018.

In preparation for the workshop, I am reaching out to you to follow up on a few items. Please note requests and due dates below:

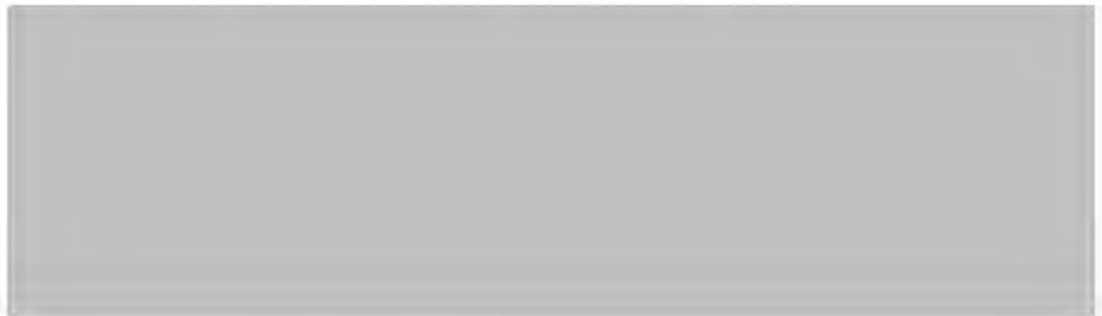
Due dates to note:


December 29, 2017 – Biography, presentation title & presentation special requirements. Details below. Please send to me by email admin@cahs-bc.ca

January 9, 2018 – Presentations for workshop. Details below.

January 17, 2018 – Travel expenses receipts due. Please send to me by email admin@cahs-bc.ca

- 1) **Biography:** Please provide a short bio of yourself that will be included in the workshop agenda by **Friday, Dec 29th**. Please limit your bio to a maximum of 100 words. Below is an example of the format.




- 2) **Talk Title:** Please provide your presentation title to me - if different than the title in the attached workshop agenda for the final agenda brochure by **Friday, Dec 29th**.
- 3) **Presentations:**
 - a. **Workshop Version:** Please send a copy of your presentation (PPT/PDF) in advance of the workshop to  by **Tuesday, Jan 9th** or provide us with a USB drive at the Maritime Heritage Centre by **9:30 am on Wednesday, Jan 10th**. If this is not possible, please get in touch with Ahmed to make other arrangements.
 - b. **Presentation Special Requirements:** If you have special requirements for your presentation, please let me know by **Friday, Dec 29th**.
- 4) **Travel Expenses** – Please save copies of your travel receipts. Should you require reimbursement from the BCSFA for your travel expenses, I will collect copies of receipts from you following the workshop. Email scanned receipts to me by **Wednesday, Jan 17, 2018**.
- 5) **Event Wednesday evening:** The BCSFA is hosting a reception for workshop speakers and attendees at the Riptide Marine Pub in Campbell River on the evening of Tuesday, January 10th from 6 pm to 9 pm. Enjoy a variety of appetizers and beverages while networking with fellow guests.

At this time, we have 70 people attending the workshop. The workshop agenda is attached. If you have any questions, please let me know. We look forward to seeing you all in the new year!

Best regards and Happy Holidays!

s.19(1)


BC Centre for Aquatic Health Sciences
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Mailing Address: PO Box 25070 Tyee, Campbell River, BC, Canada V9W 0B7
ph: 250 286-6102 f: 250 286-6103
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Approaches to Integrated Pest Management for Sea Lice Workshop

January 10 & 11, 2018

Maritime Heritage Centre

Campbell River, BC



Day 1 January 10, 2018

10:00 – 10:05 am	BCSFA Introduction
10:05 – 10:10 am	Moderator: [REDACTED] — Introductions & Outline
10:10 – 10:40 am	[REDACTED] — Integrated Pest Management - An overview of integrated pest management, & it's applications in various agricultural settings, globally.
10:40 – 11:10 am	Kari Olli Helgesen —Integrated Pest Management (IPM) in action in the salmon farming industry
11:10 – 11:30 am	Break
11:30 – 12:00 pm	Adrienne Paylor —DFO Sea Lice Program – Sea Lice Management in British Columbia – A Regulatory Perspective
12:00 – 1:00 pm	Lunch
1:00 – 1:30 pm	[REDACTED] —Sea Lice Management in British Columbia – Past, Present & Future
1:30 – 2:00 pm	Crawford Revie —BC Sea Lice Monitoring Database: An overview of research & findings in the development of a novel historical database covering sea lice in farm-raised & wild salmon populations in B.C.
2:00 – 2:20 pm	Break
2:20 – 2:45 pm	Tor Einar Horsberg —Sea lice IPM – Chemotherapeutant usage, now & in the future
2:45 – 3:10 pm	[REDACTED] —An Overview of SLICE® & the SLICE Sustainability Project (SSP) as Components of an Integrated Sea Lice Management Process
3:10 – 3:35 pm	[REDACTED] —Salmosan Application & Sustainability in BC: An overview of permitting in Canada, application & environmental sustainability.
3:35 – 3:50 pm	Break
3:50 – 4:15 pm	[REDACTED] —H ₂ O ₂ Application & Sustainability in BC: An overview of permitting in Canada, application & environmental sustainability.
4:15 – 5:00 pm	Day 1 Wrap Up

Moderator: [REDACTED]

SCHEDULE

Evening Reception January 10, 2018

Evening Reception (Drop-in)

6:00 – 9:00 pm Drinks & Appetizers

Riptide Marine Pub

(1340 Island Highway, Campbell River)



Day 2 January 11, 2018

8:30 – 8:45 am	Moderator [REDACTED] – Day 1 Recap & Introductions
8:45 – 9:30 am	[REDACTED] – Other Management Techniques in Practice (Norwegian perspective): An overview of the non-chemical management practices implemented by Marine Harvest ASA to take an integrated approach to the management of sea lice
9:30 – 10:00 am	[REDACTED] – A B.C. example – cleaner fish research: An overview of on-going research investigating the potential for local perch species as “cleaner fish” for the B.C. salmon farming industry.
10:00 – 10:15 am	Break
10:15 – 10:45 am	Laura Bianucci—Hydrodynamic models & their use in Integrated Pest Management
10:45 – 11:15 am	Sophie St Hilaire—How the epidemiology of sea lice can inform integrated pest management plans
11:15 – 11:30 am	Break
11:30 – 12:00 pm	[REDACTED] – Sea lice genomics: A multifaceted approach for improving parasite management
12:00 – 12:30 pm	[REDACTED] – Nutrition for Integrated Pest Management
12:30 – 1:30 pm	Lunch
1:30 – 3:00 pm	Moderators: Simon Jones & [REDACTED] – Advancing Integrated Pest Management in British Columbia Break Out Group & Panel Discussions

SCHEDULE

Presenters

Moderator – [REDACTED] BC Centre for Aquatic Health Sciences

[REDACTED] Merck Animal Health

Kari Olli Helgesen, Norwegian Veterinary Institute

Kari Olli Helgesen is a Norwegian veterinarian with a PhD in aquatic veterinary pharmacology. She is currently working for the Norwegian Veterinary Institute, where she is leading the sea lice research group for the Epidemiology section. Her research has focused on mechanisms for resistance in sea lice & methods for resistance detection. Today, she is also responsible for the national surveillance program for resistance in sea lice in Norway.

Adrienne Paylor, Fisheries & Oceans Canada

Ms Paylor is currently the Regional Manager for DFO Aquaculture Environmental Operations responsible for overseeing the Fish Health Auditing & Surveillance Program which includes sea lice compliance monitoring. Prior to this position, Ms Paylor was the Regional Manager for Aquaculture Management in Central & Arctic Region & has been working with the Department of Fisheries & Oceans for over 20 years including the Oceans Management Program, Habitat Management Program & Science division of DFO. Ms Paylor's education includes a Masters in Integrated Natural Resource Management specializing in sustainable development, a Bachelor's of Science with a split major in Biology & Environmental Science & a Diploma in Biological Technology.

[REDACTED] Marine Harvest Canada

APPROACHES TO INTEGRATED PEST MANAGEMENT FOR SEA LICE
WORKSHOP

Presenters

Crawford Revie, Atlantic Veterinary College, UPEI, Canada

Crawford holds a Canada Research Chair in *Epi-Informatics*, which he defines as, "the use of techniques from informatics - such as data mining & data-driven modelling - to better understand disease at a population level". His research explores novel methods to extract & organize knowledge that exists in large/complex epidemiological data sets. A focus over the past decade has been the application of data-driven models to better understand host-parasite population dynamics in aquatic settings – particularly sea lice on salmon farms, in all of the major Atlantic salmon producing regions.

Tor Einar Horsberg, Norwegian University of Life Sciences

Dr. Horsberg is a professor in veterinary pharmacology at the Norwegian University of Life Sciences. He has a DVM degree from 1983 & a PhD from 1991, both from the Norwegian School of Veterinary Science. He has worked with chemotherapeutants against sea lice since 1986. Most of his work has been on resistance development & resistance management where he has been involved in several larger projects funded by the EU 5th framework & the Norwegian Research Council.

Merck Animal Health

Fish Vet Group

APPROACHES TO INTEGRATED PEST MANAGEMENT FOR SEA LICE
WORKSHOP

Presenters

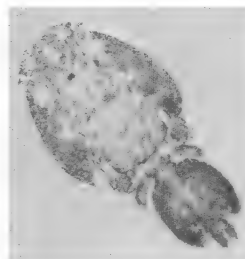
Aqua Pharma AS

Marine Harvest ASA

BC Centre for Aquatic Health Sciences

Laura Bianucci, Fisheries & Oceans Canada

Dr. Bianucci is an oceanographer with expertise in numerical models that represent both the physics & biology of the ocean environment. These type of models have many useful applications in the area of aquaculture, e.g. understanding the risk of disease propagation among nearby farms. Dr. Bianucci earned her PhD at the University of Victoria (Victoria, BC) & completed postdoctoral studies at Dalhousie University (Halifax, NS). She was a Scientist at Pacific Northwest National Laboratory in Seattle (WA) before joining the Institute of Ocean Sciences (Fisheries & Oceans Canada) as a Research Scientist in 2017.



APPROACHES TO INTEGRATED PEST MANAGEMENT FOR SEA LICE
WORKSHOP

Presenters

Sophie St-Hilaire, City University of Hong Kong

Prof. St-Hilaire received her veterinary degree from the University of Prince Edward Island (UPEI), Canada in 1994. She then completed her MSc & PhD in veterinary epidemiology at the University of Saskatchewan & the University of Guelph, respectively. She also holds an MBA from UPEI.

Before joining City University of Hong Kong, she was a Canada Research Chair at the Atlantic Veterinary College, Prince Edward Island, Canada. Prior to that appointment she was an associate professor at Idaho State University in the U.S. She also has worked for a number of government agencies including: the Department of Fisheries & Oceans in Canada, the Centre for Environment, Fisheries & Aquaculture Science in the UK, & the Chilean Government.

Centre for Aquaculture Technologies Canada

, Cargill Animal Nutrition

Moderator – Simon Jones, Fisheries & Oceans Canada

Simon Jones leads the Marine Parasitology Program at the Pacific Biological Station (PBS) in Nanaimo. He has a PhD in parasitology from the University of Guelph with post-doctoral training in fish immunology at Wageningen University. For several years he was a researcher in the aquaculture vaccine industry. His research at PBS focuses on the structural & genomic characterization of parasites, defense responses of fish during parasite infections, & the development & application of treatment & immunisation strategies mainly in salmonids.

APPROACHES TO INTEGRATED PEST MANAGEMENT FOR SEA LICE
WORKSHOP

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The Aquaculture Collaborative Research & Development Program (ACRDP) is a Fisheries & Oceans Canada (DFO) initiative that promotes collaborative research & development activities between the aquaculture industry & the department. The Program teams industry representatives with DFO researchers.



APPROACHES TO INTEGRATED PEST MANAGEMENT FOR SEA LICE
WORKSHOP

Paylor, Adrienne

From: Paylor, Adrienne
Sent: January-08-18 12:56 PM
To: Shaw, Kerra
Subject: FW: text for Nathan's wild smolt lice data from Esperanza
Attachments: text for Nathan for chum salmon abundance data.doc

Not sure what going on with this???? Let me know what you find out so I don't get blindsided at the sea lice workshop on Wed.

Thx A

From: Keith, Ian
Sent: Sunday, January 07, 2018 1:23 AM
To: Paylor, Adrienne
Subject: text for Nathan's wild smolt lice data from Esperanza

Hi Adrienne,

I don't know if Nathan is presenting this at the sea lice workshop or not but he wanted me to frame his sampling program as he was writing it up.

You should advise on how you would like this framed. I am blunt, because it should be a blunt message. BCSFA should have applied pressure on its members and the vets should have pressured peers. This should not be presented as, "we were following the rules."

Thanks

Ian

Dr. Ian Keith DVM
Field Operations Veterinarian - Pacific Region
Fisheries and Oceans Canada | Pêches et Océans Canada
Fisheries Management
Aquaculture Management Division | Gestion de l'aquaculture
Aquaculture Environmental Operations - Fish Health
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Mobile | Portable: [REDACTED]
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Ian.Keith@dfo-mpo.gc.ca

s.16(2)(c)

Steamer and Esperanza had direct entry from Gold River and Paradise hatcheries in Winter 2015, and sea lice abundance was low until Esperanza (AQFF 113718) exceeded the threshold with 4.5 average from counts completed on 28-July-2016. Arrangements for a SLICE treatment commencing sometime in August was the plan for management. Plankton precluded treatment and counts in Esperanza Inlet in August and Steamer exceeded the threshold with 14.4 average from counts completed on 6-September-2016. However, the September report did not indicate that treatment had started 14-September-2016

The veterinarian said 11-November-2016 that resistance was suspected and that bioassays were being repeated. DFO Veterinarians agreed that the bioassay had to be repeated in order to have an endpoint. Received bioassay results 25-November-2016 with an LD50 exceeding any known in BC to DFO's knowledge. Received a report with data and assessment 1-December-2016, and a plan for peroxide treatment facilitated by MHC loaning of equipment to have abundance below threshold for March 1; abundance was 12.5, inventory, [REDACTED], and 15.5, inventory, [REDACTED] for Esperanza and Steamer respectively, December 2016 (calculated mid month inventory). The proposed action, to use peroxide to bring abundance below threshold March 1 would not worsen the situation to March 1 given anticipated low salinity early winter to reduce motile, pre-motile stages, and fecundity (Arriagada et al., 2016). Abundance determination of outmigrating smolts would be a measure of the dissemination of the resistant lice from the inlet to the greater lice population.

The company could not follow its plan. Peroxide treatment started in latter April [REDACTED]

Destruction of the resistant lice should have occurred in September. [REDACTED]

[REDACTED] Peroxide and harvesting are not appropriate methods for managing SLICE resistant lice.

Abundance

Site	Dec 2016	Jan 2017	Feb	Mar	April	May	June	July
Esperanza	12.6	31.8	48.3	39.8	16.0	4.7	9.8	<4 pens
Steamer	15.4	26.0	37.4	33.3	2.9	15.4	<4 pens	fallow

Harvest as management

Site	Dec 2016	Jan 2017	Feb	Mar	April	May	June	July
Esperanza				[REDACTED]				0
Steamer				[REDACTED]				0

Action plan: 4x per week harvest beginning first week of March using the Silver Dolphin rather than the larger harvest vessels on the Steamer and Esperanza licences, Viking Star and Discovery Dawn. [REDACTED]

s.20(1)(b)

s.21(1)(b)

Waddington, Zac

From: Waddington, Zac
Sent: January-10-18 8:17 AM
To: Keith, Ian
Subject: RE: Letter to Cermaq

Thanks very much for clarifying that Ian. I'll chat with you today and we can see what plan makes sense.

Zac

From: Keith, Ian
Sent: Tuesday, January 09, 2018 9:24 PM
To: Waddington, Zac
Subject: RE: Letter to Cermaq

Hi Zac,

I reviewed my notes from the October SL report and misspoke today. Your notes in the October Comments SL CSV are right, that [REDACTED] said SLICE tissue levels were okay. He also said that Saranac and Mussel were treated at the same time and responded well, and I said that the late chum run will bring additional lice and so [REDACTED] was mininterpreting the presence of lice on the Millar Channel fish.

Treatment October 10 at Dixon, Millar, and Rant is early in order to have residual therapeutic levels at the time of this chum run. (I said 42 days before levels drop below therapeutic levels, but this is for therapeutic levels based on historic sensitive levels.) So, as before, I don't think there is necessarily resistance at these farms despite [REDACTED] comments about resistance, and therefore I have to retract my questioning whether he has under-dosed.

It could be that [REDACTED] was more successful because of changes in climate and additional years of aquaculture in Clayoquot. And it could be that [REDACTED] choice of huge management area for coordinated treatment is defensible although we know that lice behaviour is more localised. Millar Channel sites, Ross, Millar, Bawden, Dixon should be treated as an area in my opinion, after the rest of Tofino North.

This said, and why I asked about having Cermaq harvest plan in writing, is I see in [REDACTED] plan the same pattern as I sawa from Grieg and MHC. [REDACTED]

Cermaq has their grade harvest starting in February for Millar, March for Ross, but completion of harvest for Dixon finished by March. I assumed to harvest to empty these farms by end of February but now suspect that [REDACTED] is proposing to advance Ross harvest one month.

Ian

Dr. Ian Keith DVM
Field Operations Veterinarian - Pacific Region
Fisheries and Oceans Canada | Pêches et Océans Canada
Fisheries Management
Aquaculture Management Division | Gestion de l'aquaculture
Aquaculture Environmental Operations - Fish Health
#103 - 2435 Mansfield Drive
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Telephone | Téléphone: 250-703-0917
Mobile | Portable: [REDACTED]
Fax | Télécopieur: 250-703-0921
Ian.Keith@dfo-mpo.gc.ca

s.16(2)(c)

s.19(1)

s.20(1)(b)

s.21(1)(a)

s.21(1)(b)

From: Waddington, Zac
Sent: Tuesday, January 09, 2018 5:21 PM

To: Keith, Ian

Subject: Letter to Cermaq

See what you think Ian,

We have reviewed the November sea lice data for the Clayoquot farms: Dixon, Millar Channel and Ross Pass. As I'm sure you are aware, they are over threshold despite SLICE treatments at the end of September/ beginning of October at all three sites. The expected residual effect of SLICE has not been observed, and some of the sites continue to trend upwards. We are aware of the difficulties faced by Cermaq in getting the approvals necessary for the use of Paramove in Clayoquot. Though we empathize with this challenge, we want to reiterate the expectation that your lice burden on affected farms will be effectively dealt with by the beginning of the out migration period beginning in March, as per the conditions of licence. If harvest is to be the tool of management, it is expected that this will be finished by the end of February.

Thanks again for your cooperation and compliance,

Dr. Zac Waddington DVM, B.Env.Sc (Hons)
Lead Veterinarian - Pacific Region
Fisheries and Oceans Canada | Pêches et Océans Canada
Aquaculture Environmental Operations - Fish Health
Courtenay, British Columbia V9N 2M2
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Zac.Waddington@dfo-mpo.gc.ca

Waddington, Zac

From: Waddington, Zac
Sent: January-10-18 8:22 AM
To: Keith, Ian
Subject: RE: Letter to Cermaq

I think your edits are entirely appropriate, and I have no issue with C and P reviewing to ensure that it does cover the bases needed. Do you want to forward that to Joe or someone else?

Zac

From: Keith, Ian
Sent: Tuesday, January 09, 2018 10:28 PM
To: Waddington, Zac
Subject: RE: Letter to Cermaq

Hey Zac,

The attached has my suggested edits that are consistent with my earlier email regarding the situation. Regardless of the flack, I think that it is appropriate to have C&P review the letter in order to get their support.



Ian

From: Waddington, Zac
Sent: January-09-18 5:21 PM
To: Keith, Ian
Subject: Letter to Cermaq

See what you think Ian,

We have reviewed the November sea lice data for the Clayoquot farms: Dixon, Millar Channel and Ross Pass. As I'm sure you are aware, they are over threshold despite SLICE treatments at the end of September/ beginning of October at all three sites. The expected residual effect of SLICE has not been observed, and some of the sites continue to trend upwards. We are aware of the difficulties faced by Cermaq in getting the approvals necessary for the use of Paramove in Clayoquot. Though we empathize with this challenge, we want to reiterate the expectation that your lice burden on affected farms will be effectively dealt with by the beginning of the out migration period beginning in March, as per the conditions of licence. If harvest is to be the tool of management, it is expected that this will be finished by the end of February.

Thanks again for your cooperation and compliance,

Dr. Zac Waddington DVM, B.Env.Sc (Hons)
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s.21(1)(a)

s.21(1)(b)

Paylor, Adrienne

From: Paylor, Adrienne
Sent: February-02-18 8:20 PM
To: Keith, Ian
Subject: Re: for your review SVP

Yes very good thank you for the SVP.
Adrienne

Sent from my BlackBerry 10 smartphone on the Rogers network.

From: Keith, Ian
Sent: Friday, February 2, 2018 8:06 PM
To: Paylor, Adrienne
Subject: for your review SVP

And thank you for the plans submitted, as per licence conditions. Millar Channel is predictable with the chum spawn in the late fall, with a spike in motile counts on the fish in the farms in the channel. The December count data from Ross, Dixon and Millar have next to no chalimus but high motiles, consistent with effective treatment in early fall and recruitment of motiles from the spawning fish. Zac appreciates the cycles affecting lice abundance too and was expecting the drop in abundance at Dixon with the winter rains.

It is a relief that Bawden lice bioassay is favourable because with the chalimus on these fish would not predict successful manage with rains, despite Arriagada et al. (2016) data that would predict some effect on pre-motile stages.

I have two matters regarding this sea lice management plan and sea lice management plans in general to raise: one, to explain that management plans contingent on borrowed equipment and permits not yet in hand should not be assumed to meet approval under any circumstances; and two, implied in Zac's letter to you in mid January is that accelerated harvest is an option when threshold is met during the outmigration period, that the requirement is abundance below threshold March 1.

- with the proximity of the wellboat we consider the plan to be do-able, if necessary.

I am pleased that you have applied for a pesticide use permit for Clayoquot; however, as emphasized at the Integrated Pest Management workshop January 10-11 it is our expectation that preparations are secured for integrated sea lice management going forward, whether permits and equipment for hydrogen peroxide or physical lice removal.

Dr. Ian Keith DVM
Field Operations Veterinarian - Pacific Region
Fisheries and Oceans Canada | Pêches et Océans Canada
Fisheries Management
Aquaculture Management Division | Gestion de l'aquaculture
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Mobile | Portable: [REDACTED]
Fax | Télécopieur: 250-703-0921
Ian.Keith@dfo-mpo.gc.ca

s.16(2)(c)

s.19(1)

s.20(1)(b)

Waddington, Zac

From: Waddington, Zac
Sent: February-21-18 1:30 PM
To: Sandberg, Krista
Subject: RE: Clayoquot sea lice numbers

Thanks a bunch

From: Sandberg, Krista
Sent: Wednesday, February 21, 2018 12:44 PM
To: Waddington, Zac
Subject: Re: Clayoquot sea lice numbers

Aqua/active finfish/finfish/ grieg/fish health/sea lice

Or something like that

Sent from my BlackBerry 10 smartphone on the Rogers network.

From: Waddington, Zac
Sent: Wednesday, February 21, 2018 11:58 AM
To: Sandberg, Krista
Subject: RE: Clayoquot sea lice numbers

Yes I can....sorry I failed to make that leap on my own. Where is that data stored again?

Zac

From: Sandberg, Krista
Sent: Wednesday, February 21, 2018 11:56 AM
To: Waddington, Zac
Subject: Re: Clayoquot sea lice numbers

I haven't done December or January yet but you can look at the raw data in the company folders.

Sent from my BlackBerry 10 smartphone on the Rogers network.

From: Waddington, Zac
Sent: Wednesday, February 21, 2018 11:32 AM
To: Sandberg, Krista
Subject: Clayoquot sea lice numbers

I was hoping to take a look at the sea lice numbers for Cermaq out in Clayoquot to see how they are looking in 2018. There's nothing entered in the sea lice csv. File for Dec. 2017 or 2018. Do we have any current numbers that I could take a peek at? I see that you are out of office, so no panic on this.

Dr. Zac Waddington DVM, B.Env.Sc.(Hons)
Lead Veterinarian - Pacific Region
Fisheries and Oceans Canada | Pêches et Océans Canada
Aquaculture Environmental Operations - Fish Health

Courtenay, British Columbia
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Zac.Waddington@dfo-mpo.gc.ca

No information has been removed or severed from this page

Waddington, Zac

From: Manchester, Howie
Sent: February-26-18 11:04 AM
To: Keith, Ian; Waddington, Zac
Subject: Fw: Additional sea lice audit at Ross Pass

I would think we have determined it necessary. Have contacted company, will make arrangements with the site.

Not sure it's necessary but do you think it's a good idea to give [REDACTED] a heads up? Might circumvent some headaches?

Howie

Sent from my BlackBerry 10 smartphone on the Bell network.

From: Keith, Ian <Ian.Keith@dfo-mpo.gc.ca>
Sent: Monday, February 26, 2018 10:41 AM
To: Manchester, Howie
Cc: Waddington, Zac
Subject: RE: Additional sea lice audit at Ross Pass

Hi Howie,
Greg and Joe say that the Ross inspection is necessary, and that it is an inspection not an investigation. Adrienne and Allison have been contacted by Ministry of Environment regarding the Pesticide Use Permit for Clayoquot is the only update we have.
Ian

From: Manchester, Howie
Sent: February-25-18 10:57 AM
To: [REDACTED]
Cc: [REDACTED] Waddington, Zac; Keith, Ian
Subject: Additional sea lice audit at Ross Pass

Hi [REDACTED]

There will be an amendment for the audit to be conducted at Ross Pass.

After reviewing submitted sea lice records and since we are in the area our veterinarian thinks it would be beneficial to extend our audit coverage in the area. We will, therefore, need to conduct an Seal Lice Audit in addition to the Fish Health Audit at Ross Pass. If you have any questions or would like to discuss further please contact our DFO veterinarians directly at Dr. Ian Keith 250-703-0917 or Dr. Zac Waddington 250-703-0902.

Please let me know if there are concerns or questions regarding this change.

Thank you for adjusting your preparations to accommodate this. Please note the Sea Lice Preparations refresher below.

s.19(1)

Howie

SL Audit Preparations:

- It is not desirable to sample fish for a DFO SL Audit during or within a few weeks (21d) of a slice treatment. Ideally Industry FH staff will have made us aware, well in advance of the audit, if a scheduled SL audit falls within a treatment or within a few weeks of a treatment ending. In those cases, and with notice, we're able to re-select for the site. That said, please make DFO staff aware of any Slice or H2O2 treatments that may impact lice numbers, i.e. communicate the end date of any recent treatments (within the last month), if applicable.
- A Sea Lice Audit can be postponed due to a recent transfer but this is not mandated by the licence. Industry may choose to delay handling for SL sampling following a recent transfer. Typically 30days is a common convention for "recent" in this context. From our audit scheduling perspective, the data obtained are not as valuable so soon after a recent SW entry and we would ideally wait until 3 pens have been onsite longer than 30 days following smolt entry from a hatchery. For sea to sea transfers the full 30days is not required; an audit can be scheduled when the facility is comfortable handling fish.
- Please be ready.
- We always do 3 pens (one of which is your reference) and 20 fish per pen. We always count the tote for each pen after 20 fish.
- Feel encouraged to contact us directly to pin down an ETA, if necessary, to help you plan and be prepared. Anything you can do to have nets in the water, gear set up and additional nets to avoid having to move equipment is greatly appreciated. Thank you.
- Please be adequately staffed. This is your audit and DFO is hands off with the exception of counting half the fish.
- Remember that we do not take grilse fish during a DFO SL audit. If you have a high number of maturing fish please plan accordingly to ensure a random sample of 20 fish can be caught in a reasonable time frame.
- It's your call as to whether or not you feed your fish before the SL audit. Please ensure that you are able to catch fish in a reasonable period of time for the audit. We are generally limited to about 3 hours on site. Please plan for that and communicate any foreseeable issues with expediency in advance, so our field team can discuss and plan with the site.
- If you are experiencing low DO or any other event that may preclude scheduled SL sampling, please communicate this to DFO in advance of the audit, if known.
- We will often ask to split up and start the FH and SL audits simultaneously. It's great when that can be accommodated. Thanks in advance for being ready for that when able. If being ready to divide and conquer requires you to pump morts (all or partially) in advance of DFO arrival please discuss this with DFO FH in advance of the audit as the field team may have flexibility to avoid this.

Delaney, Paula

From: Paylor, Adrienne
Sent: March-06-18 6:06 PM
To: Webb, Allison
Subject: Fw: lice update

FYI

Below is our vet to vet communication regarding elevated sea lice levels heading into the out migration window. Ian will get us an update on harvest rate and progress in the morning in case it comes up at FAIAP.

A

Sent from my BlackBerry 10 smartphone on the Rogers network.

From: Keith, Ian <Ian.Keith@dfo-mpo.gc.ca>
Sent: Tuesday, March 6, 2018 4:58 PM
To: Paylor, Adrienne
Subject: FW: lice update

Dr. Ian Keith DVM
Field Operations Veterinarian - Pacific Region
Fisheries and Oceans Canada | Pêches et Océans Canada
Fisheries Management
Aquaculture Management Division | Gestion de l'aquaculture
Aquaculture Environmental Operations - Fish Health
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Fax | Télécopieur: 250-703-0921
Ian.Keith@dfo-mpo.gc.ca

s.16(2)(c)

s.19(1)

From: Keith, Ian
Sent: Sunday, February 18, 2018 12:03 AM
To: [REDACTED]
Cc: [REDACTED]
Subject: RE: lice update

Hi [REDACTED]

I expected the rise in chalimus counts in January counts at Millar and Ross given that January's rainfall failed to reduce abundance at these farm to below threshold as of end of January. Good job in initiating harvesting at full rate at Millar and Ross [REDACTED]

If you were able to have permits and Grieg's wellboat, you were going to start peroxide treatment beginning Thursday, February 15, as the alternative to harvest. Please give us an update. I trust that SLICE treatment at Bawden went well.

This is an opportunity to raise two matters regarding sea lice management plans in general. These are: 1) as a reminder in Zac's letter to you in mid January, harvest "which will reduce the absolute lice inventory" is an option when threshold

is met during the outmigration period, the regulation is to enter the outmigration period below threshold; 2) we supported registration of hydrogen peroxide so it is industry's responsibility to make use of this tool as an alternative to harvest and to preserve SLICE efficacy. Your plan has reflected this understanding – your harvesting rate, given when you started, would allow you to meet regulation if peroxide treatment hasn't been possible.

Thanks [REDACTED]

Regards,
Ian

Dr. Ian Keith DVM
Field Operations Veterinarian - Pacific Region
Fisheries and Oceans Canada | Pêches et Océans Canada
Fisheries Management
Aquaculture Management Division | Gestion de l'aquaculture
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Mobile | Portable: [REDACTED]
Fax | Télécopieur: 250-703-0921
Ian.Keith@dfo-mpo.gc.ca

From: [REDACTED]
Sent: Friday, February 02, 2018 4:46 PM
To: Keith, Ian
Cc: [REDACTED]
Subject: lice update

Hi Ian,

Sorry I missed your call. Left a message but essentially: we continue to await the peroxide permit for use in Tofino. We've coordinated as if it were available and the MD even sat down with MOE and the MD to stress the importance - still waiting. In the interim the lice levels have reduced significantly below 3 motile lice/ fish at Dixon due to low salinity. Lice levels remain elevated and relatively unchanged at Ross and Millar but we have changed to harvesting those two sites to the capacity of the plant. Lice levels remain elevated and high at Bawden but we are treating at Bawden with SLICE. We will continue to monitor for lice and adjust accordingly.

I'll be [REDACTED] intermittently checking emails. In the interim you can contact either [REDACTED] for further details.

Thanks,



CERMAQ

s.19(1)

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Delaney, Paula

From: Sandberg, Krista
Sent: March-12-18 1:56 PM
To: Webb, Allison; Paylor, Adrienne
Subject: RE: 2017Q3 and Q4 sea lice audit reports ready for your review

Hi Allison,

It's interesting that you ask that question as this report is new in the last year or so. We used to report industry and DFO audit lice data all in the same report. However, a couple years ago there was a request from industry to begin posting industry submitted lice data on a monthly basis rather than quarterly. In addition, it was often difficult to compare the industry abundance to the DFO abundance because industry counts are often an average of 2 counting events (bi-weekly), and DFO counts are from a single day. Thus, to expedite the monthly reports and to make our audit data more clear, we chose to separate the 2 reports. You are correct in that the audit report does not address exceedances – this information can be found in the monthly abundance report and I think that it is very clear and transparent there. To my knowledge, we have not received any questions on this, but I think that most people who are looking at the reports likely know what they are looking for and where to find it. Perhaps we need to find a way of making that more clear.

I will be sending you the November – January sea lice abundance reports for your review as soon as I get approval from Zac and Adrienne, but if you want to look at them in the meantime, the link is here: [X:\1. PUBLIC REPORTING\Sea Lice\Monthly Farm Level \(A\)\2017\Farm Level Sea Lice \(A\) 2017 csv.xlsx](X:\1. PUBLIC REPORTING\Sea Lice\Monthly Farm Level (A)\2017\Farm Level Sea Lice (A) 2017 csv.xlsx)

Krista.

Krista Sandberg
Office | Bureau 250-286-5835
Cellular | Cellulaire [REDACTED]



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From: Webb, Allison
Sent: Monday, March 12, 2018 12:59 PM
To: Sandberg, Krista; Paylor, Adrienne
Subject: RE: 2017Q3 and Q4 sea lice audit reports ready for your review

Hi Krista – Thanks for this. This is ready to post from my perspective.

I'm assuming that this is how we have been reporting for some time now. Are we typically receiving questions where the reporting shows over our threshold levels? I don't think that this is the purpose of this report, but I am thinking that it just starts other questions and are we able to answer those in a transparent way?

Thanks,
Allison

Allison Webb, Director / Directrice
Aquaculture Management / Gestion de l'aquaculture
Fisheries Management Branch / Direction de la gestion des pêches
Fisheries and Oceans Canada / Pêches et Océans Canada
200 - 401 Burrard St / Rue Burrard, Vancouver BC / C.B. V6C 3S4 Canada
604-666-7009
Allison.webb@dfo-mpo.gc.ca

s.16(2)(c)

From: Sandberg, Krista
Sent: 2018-March-09 12:55 PM
To: Webb, Allison
Subject: FW: 2017Q3 and Q4 sea lice audit reports ready for your review

Hi Allison,

Please see below for the link to the sea lice audit report that is ready for your review. This one is the results of our audit counts compared to industry's counts on the same day. Please let me know if you have any questions.

Have a great weekend,
Krista.

Krista Sandberg
Office | Bureau 250-286-5835
Cellular | Cellulaire [REDACTED]



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From: Paylor, Adrienne
Sent: Friday, March 09, 2018 12:31 PM
To: Sandberg, Krista
Subject: RE: 2017Q3 and Q4 sea lice audit reports ready for your review

Approved thanks.
Adrienne

From: Sandberg, Krista
Sent: Friday, March 09, 2018 11:32 AM
To: Paylor, Adrienne
Subject: FW: 2017Q3 and Q4 sea lice audit reports ready for your review

Sea lice audit pending your approval, please see below...

Krista Sandberg
Office | Bureau 250-286-5835
Cellular | Cellulaire [REDACTED]



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From: Sandberg, Krista
Sent: Friday, January 12, 2018 8:02 AM
To: Paylor, Adrienne
Cc: Waddington, Zac
Subject: FW: 2017Q3 and Q4 sea lice audit reports ready for your review

Hi Adrienne,

The Q3/Q4 sea lice audit report is ready for your review. We've made a couple changes to the report including replacing "year" and "month" with "audit date" and removing the column for # of counts. I'm not sure why this was retained. It came from the original report which included the whole month's industry counts, so it never should have been there in the first place.

s.16(2)(c)

Zac, when I send the file to communications for posting, I will also request that the definitions be re-posted to reflect the changes.

Cheers,
Krista.

Krista Sandberg

Cellular | Cellulaire [REDACTED]
Office | Bureau 250-286-5835



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From: Waddington, Zac

Sent: Thursday, January 11, 2018 5:09 PM

To: Sandberg, Krista

Subject: RE: 2017Q3 and Q4 sea lice audit reports ready for your review

Yeah the changes to the working file are all good. I see in the definitions that there is a note to delete the number of counts performed, which makes sense given that it's not part of the reporting. Will that be taken out by communications?

Zac

From: Sandberg, Krista

Sent: January-11-18 4:05 PM

To: Waddington, Zac

Subject: FW: 2017Q3 and Q4 sea lice audit reports ready for your review

Hi Zac,

I've made the improvements to this report that we discussed on the phone, and I think you approved verbally, but can you please have one more look approve via email so I can send this up to Adrienne?

Thanks,
Krista.

Krista Sandberg

Cellular | Cellulaire [REDACTED]
Office | Bureau 250-286-5835



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From: Sandberg, Krista

Sent: Tuesday, January 02, 2018 3:24 PM

To: Waddington, Zac

Subject: 2017Q3 and Q4 sea lice audit reports ready for your review

Hi Zac,

s.16(2)(c)

The Q3 and Q4 sea lice audit reports are ready for your review. Please review the “working” tab. There are a couple differences that you may want to look in to. I’m not sure if you want to add the “licence holder is taking steps to correct the problem” comment or not. Let me know.

X:\1. PUBLIC REPORTING\Sea Lice\Audit Summary\Sea Lice Audit 2016-2017 csv.xlsx

Cheers,
Krista.

Krista Sandberg

Acting Senior Shellfish Aquaculture Biologist | Biologiste de l'aquaculture

Aquaculture Management Division | Gestion de l'aquaculture

Fisheries and Oceans Canada | Pêches et Océans Canada

krista.sandberg@dfo-mpo.gc.ca

Cellular | Cellulaire [REDACTED]

Office | Bureau 250-286-5835



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Canada

s.16(2)(c)

Jones, Simon

From: [REDACTED]
Sent: Wednesday, March 14, 2018 12:35 PM
To: Jones, Simon; [REDACTED]
Subject: RE: Caligus

Follow Up Flag: Follow up
Flag Status: Completed

Categories: Yellow Category

Hi Simon,

When would you need these? Right now the fish that have Caligus are on SLICE treatment so it may be difficult getting some for a couple of months.

Cheers,
[REDACTED]

From: Jones, Simon [mailto:Simon.Jones@dfo-mpo.gc.ca]
Sent: March 14, 2018 10:04 AM
To: [REDACTED]
Subject: Caligus

Hi guys,
I'm looking for ~10 specimens of adult Caligus, fixed in alcohol. Is this something that might be available from routine sea lice monitoring?
Thanks,
Simon

Simon R.M. Jones
*Aquatic Animal Health Section
Pacific Biological Station
Fisheries and Oceans Canada
3190 Hammond Bay Road
Nanaimo, British Columbia
V9T 6N7, Canada*

Tel: 250 729 8351
Fax: 250 756 7053
E-mail: simon.jones@dfo-mpo.gc.ca

<https://profils-profiles.science.gc.ca/en/profile/simon-jones>

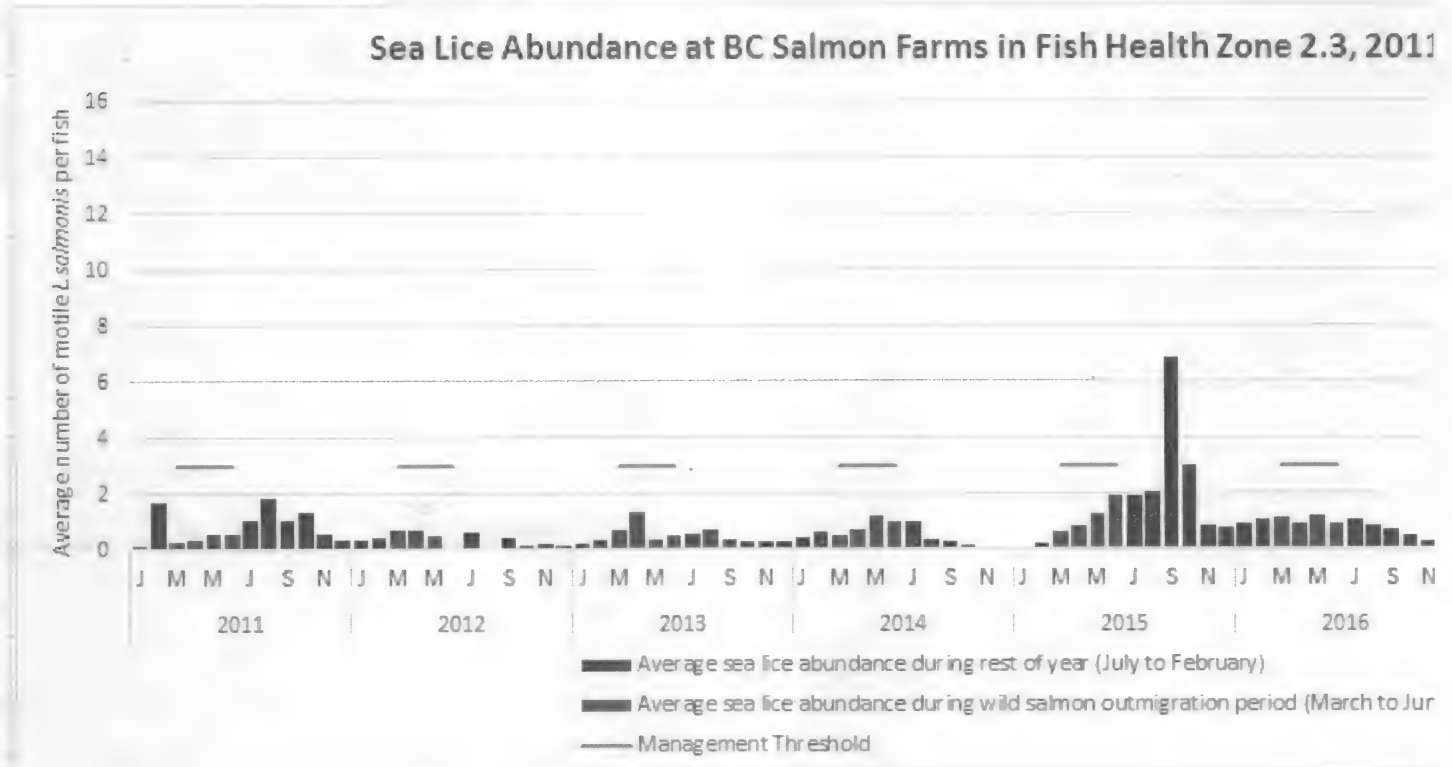
s.19(1)

<https://scholar.google.ca/citations?user=JIvmjCwAAAAJ&hl=en>

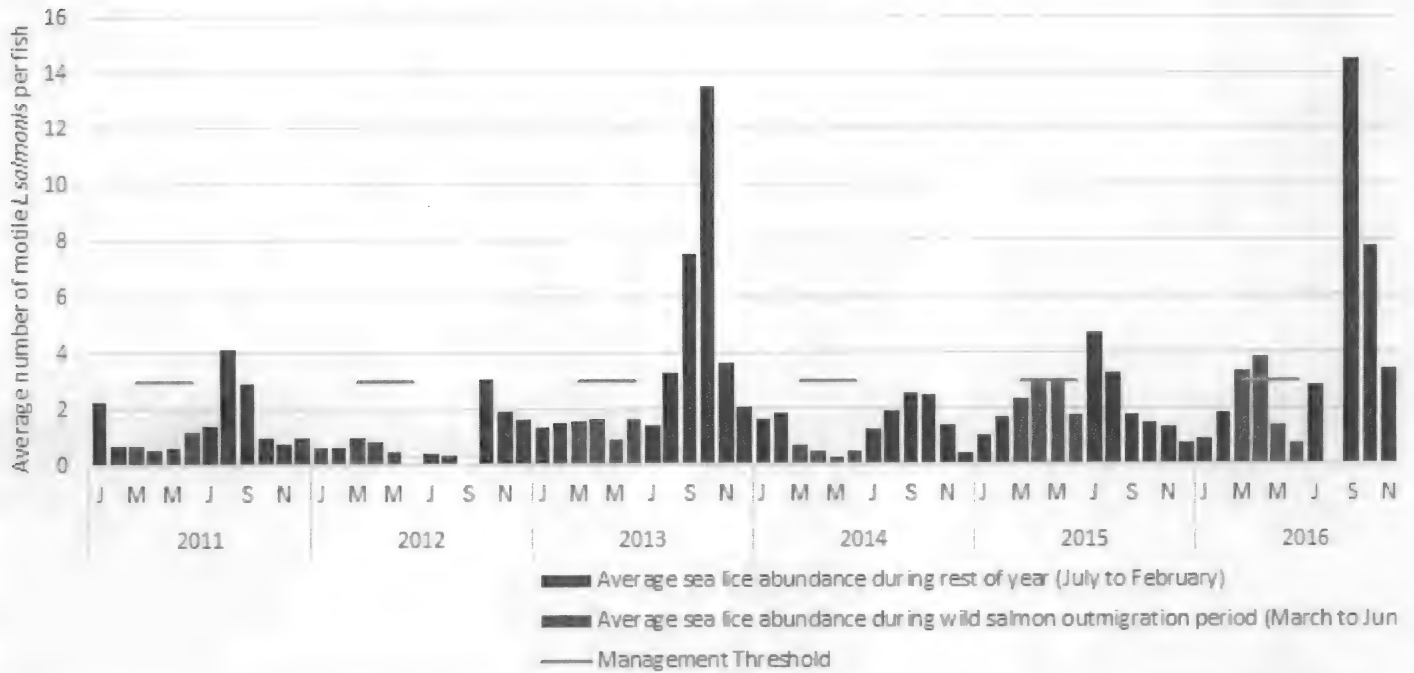
Sandberg, Krista

From: Sandberg, Krista
Sent: April-25-18 3:29 PM
To: 'Imbeau, Michelle'; Jones, Simon; Rainer, Michelle; Manchester, Howie; Waddington, Zac
Cc: Schwartzel, Margarita; Paylor, Adrienne (Adrienne.Paylor@dfo-mpo.gc.ca)
Subject: RE: Media q: sea lice monitoring

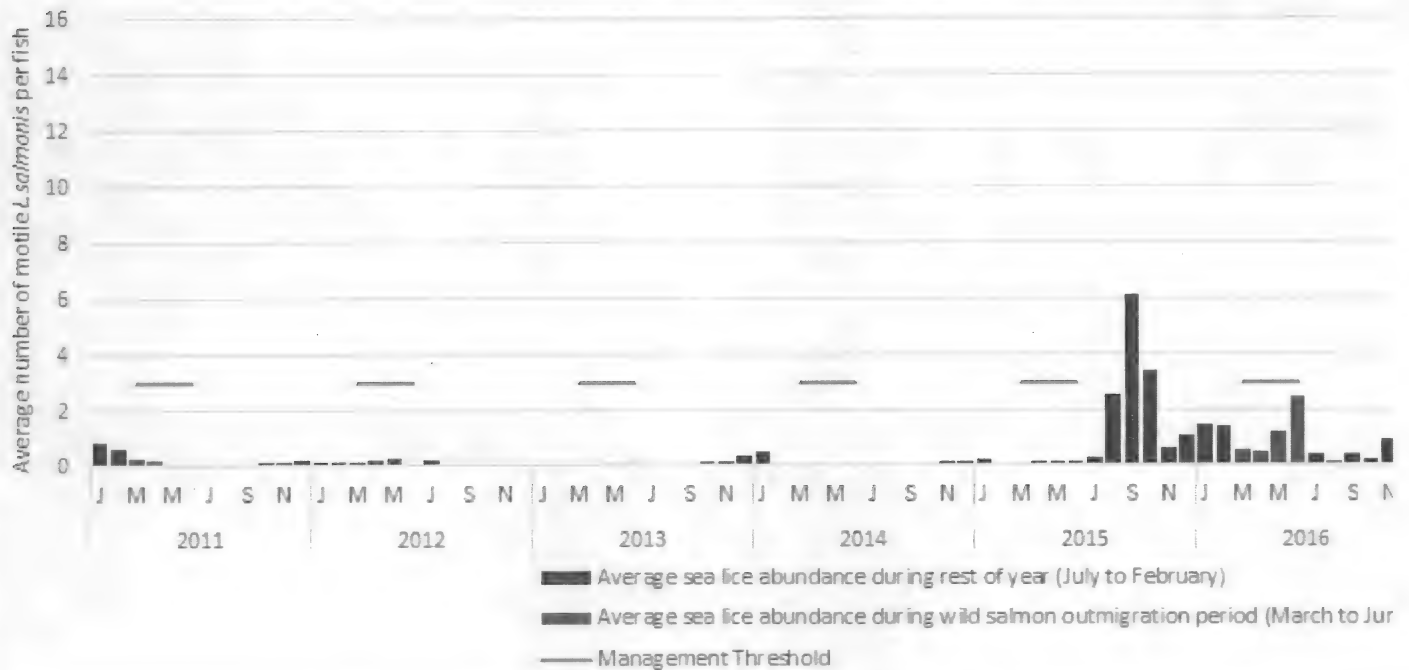
Recently completed area abundance graphs indicate that we are seeing lower lice levels in all areas except Clayoquot:



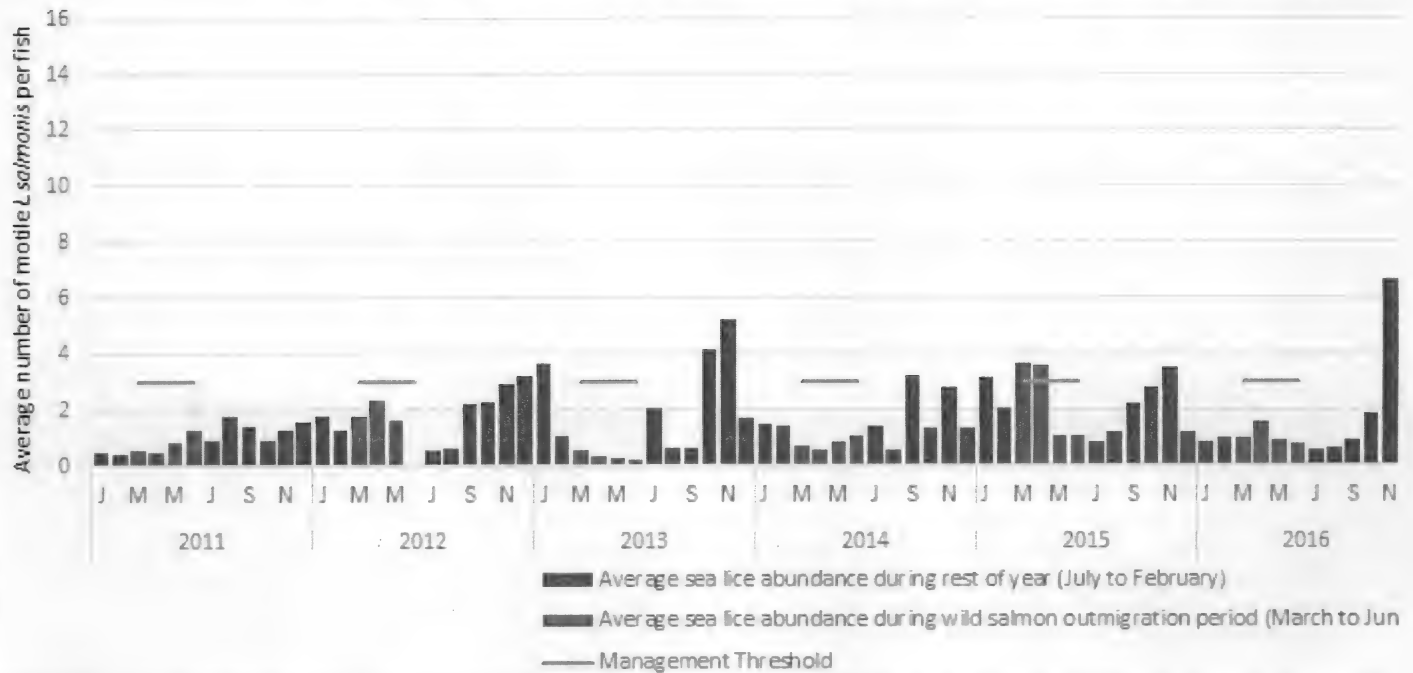
Sea Lice Abundance at BC Salmon Farms in Fish Health Zone 2.4, 2011



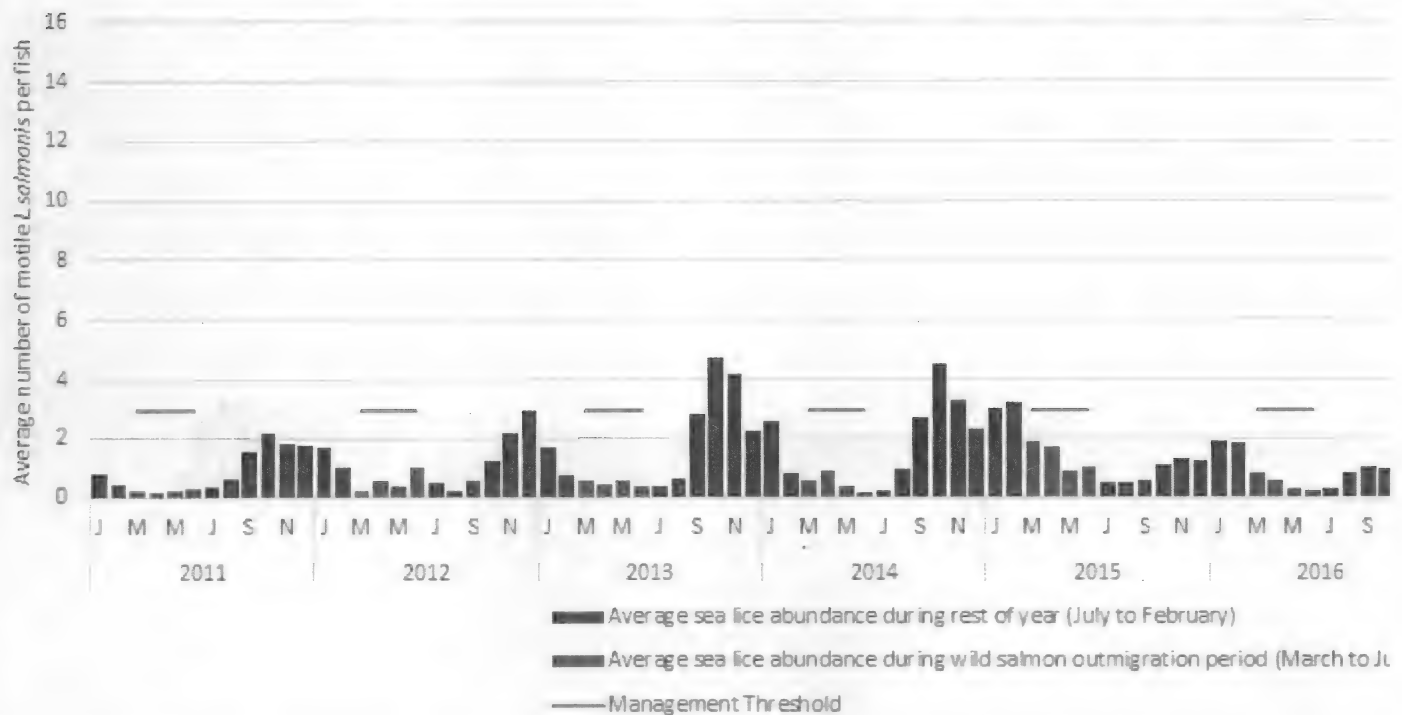
Sea Lice Abundance at BC Salmon Farms in Fish Health Zone 3.1, 2011



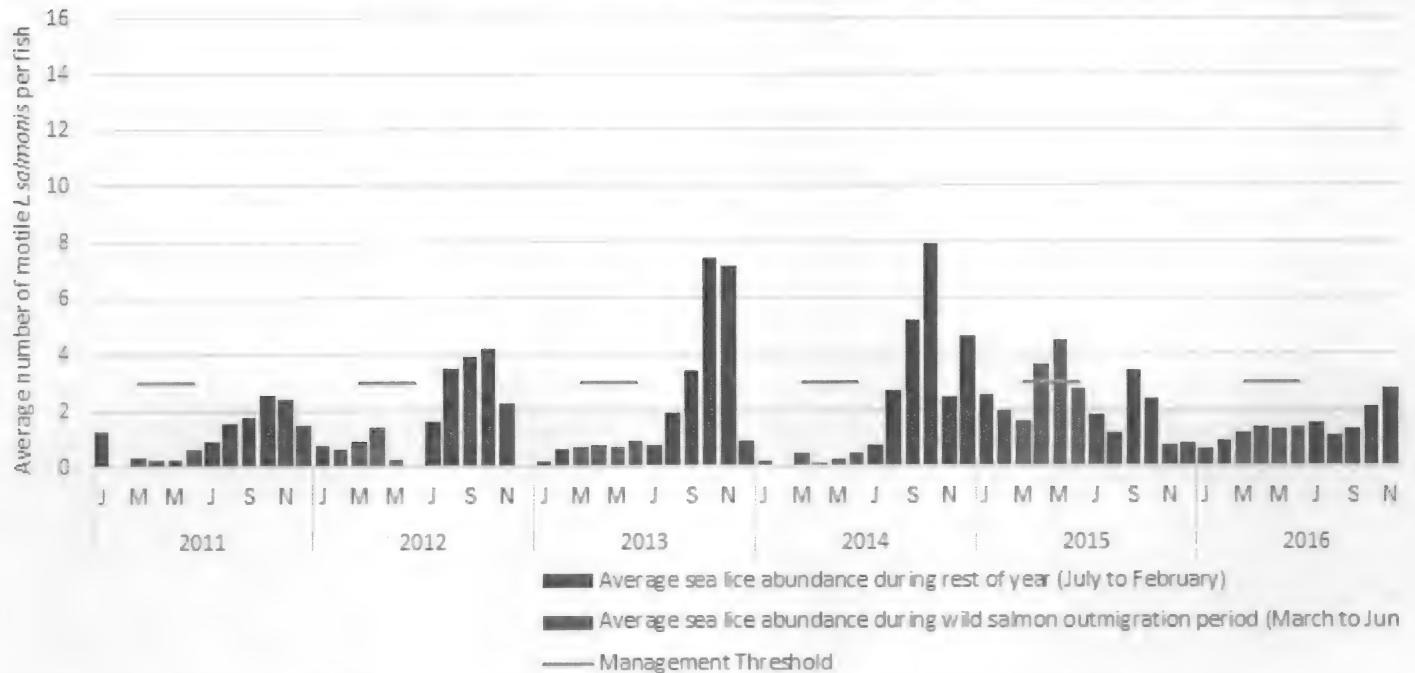
Sea Lice Abundance at BC Salmon Farms in Fish Health Zone 3.2, 2011



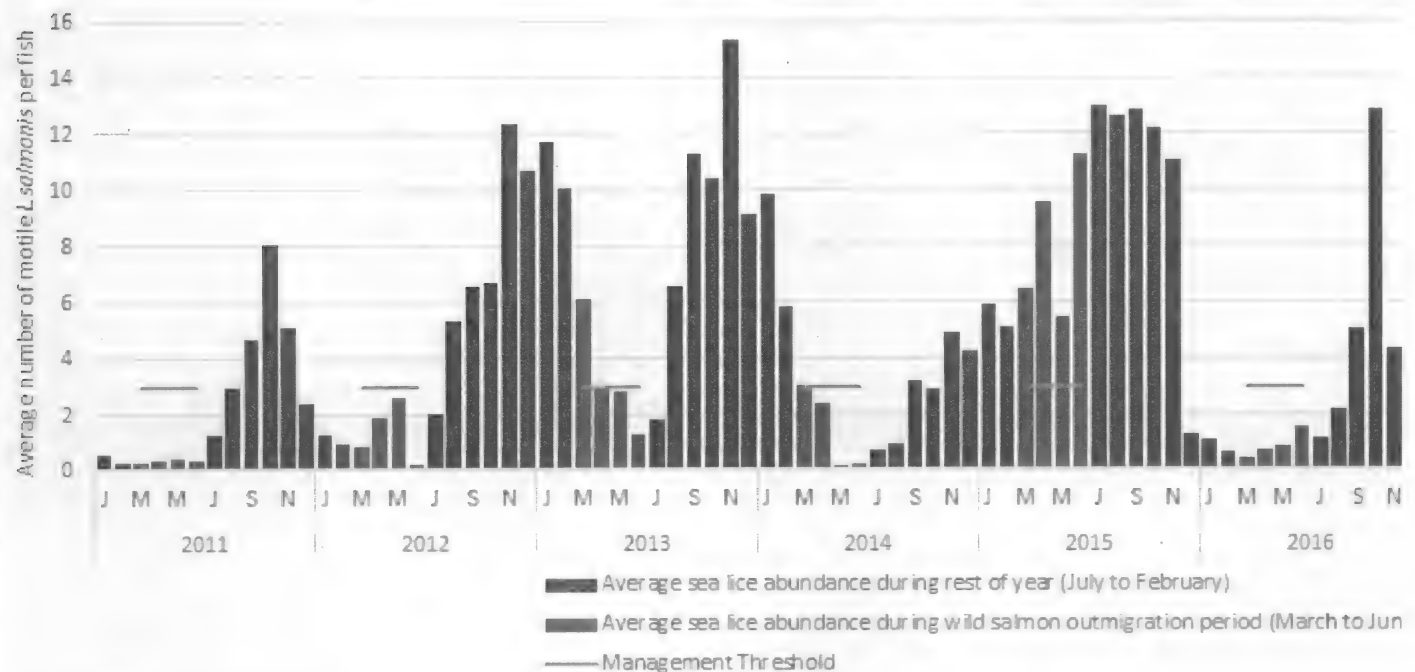
Sea Lice Abundance at BC Salmon Farms in Fish Health Zone 3.3, 2011



Sea Lice Abundance at BC Salmon Farms in Fish Health Zone 3.4, 2011



Sea Lice Abundance at BC Salmon Farms in Fish Health Zone 3.5, 2011



Krista Sandberg

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s.16(2)(c)

From: Imbeau, Michelle

Sent: Wednesday, April 25, 2018 11:36 AM

To: Jones, Simon; Rainer, Michelle; Sandberg, Krista; Manchester, Howie; Waddington, Zac

Cc: Schwartzel, Margarita

Subject: RE: Media q: sea lice monitoring

I just did a quick search and haven't been able to find any publicly available references to record lows of sea lice. Nothing has been issued by the BCSFA, and I don't see any references on social media either.

Thanks,

Michelle Imbeau

Communications Advisor

Canadian Coast Guard / Fisheries and Oceans Canada / Government of Canada

Michelle.Imbeau@dfo-mpo.gc.ca / Tel: 604-666-2872 / Cell: [REDACTED]

Conseillère en communications

Garde côtière canadienne / Pêches et Océans Canada / Gouvernement du Canada

Michelle.Imbeau@dfo-mpo.gc.ca / Tél : 604-666-2872 / Tél cel : [REDACTED]

From: Jones, Simon

Sent: April-25-18 10:39 AM

To: Rainer, Michelle; Sandberg, Krista; Manchester, Howie; Waddington, Zac

Cc: Imbeau, Michelle; Schwartzel, Margarita

Subject: RE: Media q: sea lice monitoring

All,

Before I speak with [REDACTED] has anyone seen anything to support his statement "The aquaculture industry is reporting record lows of sea lice..."? Where is this coming from? I have not seen anything in the industry data available to DFO or in our audit data to support (or refute) this statement.

Thanks,

Simon

From: Rainer, Michelle

Sent: April-24-18 7:44 AM

To: Sandberg, Krista; Manchester, Howie; Waddington, Zac; Jones, Simon

Cc: Imbeau, Michelle

Subject: Media q: sea lice monitoring

s.16(2)(c)

s.19(1)

Hi guys, hoping you can help with this media inquiry.

I can send him a link to the public reports but can anyone help answer the question about monitoring of wild salmon for lice? Is this something aquaculture program does or would this be science?

Thanks, Michelle

Sent from my BlackBerry 10 smartphone on the Rogers network.

From: Saindon, Carole <Carole.Saindon@dfo-mpo.gc.ca>

Sent: Tuesday, April 24, 2018 7:08 AM

To: [REDACTED]

Cc: NCR Media RCN (DFO/MPO); RHQ - Media.PAC

Subject: sea lice monitoring

Good morning [REDACTED], I am copying my West Coast colleagues who will follow up with you.

Cheers, Carole

From: [REDACTED]

Sent: April-24-18 7:29 AM

To: Saindon, Carole

Subject: sea lice monitoring

Good morning Carole, I am seeking some info on this year's sea lice count in both farmed and wild fisheries on the west coast as compared to last two years.

The aquaculture industry is reporting record lows of sea lice and I want to reconfirm this with your data. Can you refer me to someone or provide me with the numbers and why its low this year compared to the previous years, if the assertion holds true.



Seawestnews.com



s.19(1)

Paylor, Adrienne

From: Paylor, Adrienne
Sent: May-01-18 12:49 PM
To: Lavigne, Lauren
Cc: Webb, Allison; McCorquodale, Brenda
Subject: Sonja's Sea Lice state of Knowledge Report
Attachments: SEA LICE Statement of Knowledge Dec 22_15.docx

This report was never officially approved by our management team but does contains some helpful info and recommendations.

Lauren are you going to pass it along to NHQ with the IPM document?

Thanks,
Adrienne

STATE OF KNOWLEDGE ON SEA LICE AND THE FUTURE OF ITS MANAGEMENT IN BRITISH COLUMBIA

Sonja Saksida DVM MSc

December 2015

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Forward

The following document was prepared for Aquaculture Management Division (AMD) of Fisheries and Oceans Canada. The document provides a summary of the state of knowledge regarding sea lice in British Columbia including its management on salmon farms. The purpose of the document is to provide information that will assist the AMD in developing and improving the current management scheme.

1 What did we know about Pacific salmon and sea lice in British Columbia prior to 2003?

1.1 Pacific Salmon

There are five main species of wild anadromous Pacific Salmon found in British Columbia (BC): Pink (*Oncorhynchus gorbuscha*), Chum (*O. keta*), Coho (*O. kisutch*), Chinook (*O. tshawytscha*) and Sockeye (*O. nerka*). Although most salmon stocks are migratory, leaving the nearshore region of BC for feeding grounds offshore, a few stocks (primarily Coho) spend their entire marine lifecycle in local waters (Beamish *et al.* 2007). Large numbers of wild salmon are found in the spring/summer during the out-migration of juvenile salmon and summer/fall when maturing salmon are returning to their natal rivers. For example between 10 and 40 million Adult Pacific salmon can pass through Queen Charlotte Strait.

Each Pacific salmon species has its own unique life-cycle although they are all semelparous (die after spawning). Pink salmon are the most abundant, smallest in size, have the shortest life cycle consisting of distinct even and odd year runs. They emerge into the marine environment shortly after hatch and have the highest straying rate. Chum salmon are also abundant, and like the Pink salmon head to the marine environment shortly after hatching where they remain for 2 to 6 years before returning to their natal rivers. Sockeye salmon remain in freshwater 1 to 3 years and then in the marine environment for 2 to 3 years. Chinook are the largest of the Pacific salmon. Young may spend up to a year in freshwater and then between 2 to 7 years in saltwater. Coho salmon spend 1 to 2 years in freshwater and up to 18 months in the marine environment.

Salmon species distribution and abundance vary regionally in BC for example:

- The South Coast Mainland has populations of all 5 species of salmon however the largest river system in the region, the Fraser River, does not have even year Pink salmon.
- Broughton Archipelago has very few Sockeye salmon.
- Central Coast (Klemtu) has no major Chinook salmon runs.
- West Coast of Vancouver Island has no major Pink salmon runs.

Very little information is available about specific migratory routes for the different stocks; particularly for juvenile stages.

1.2 Sea lice

There are 3 species most commonly reported on salmon in British Columbia

1.2.1 *Lepeophtheirus salmonis*

The species of sea louse most commonly reported on wild (Beamish *et al.* 2005) and farmed salmonids (Saksida *et al.* 2007a) in coastal BC is *Lepeophtheirus salmonis* (*L. salmonis*). Commonly it is referred to as the salmon louse. However, Jones *et al.* (2006 a, b) describe significant naturally occurring *L. salmonis* infestations on three-spine stickleback (*Gasterosteus aculeatus*) in the wild. Three-spine stickleback were one of the four most common wild non-salmonid species netted or hooked in a survey of fish near salmon farms (Kent *et al.* 1998).

Morphologically, *L. salmonis* appear identical between the North Pacific and the North Atlantic regions. Genetically, however, Todd *et al.* (2004) reported low but significant differentiation in the variation of six microsatellite loci between North Pacific and North Atlantic *L. salmonis*. Yazawa *et al.* (2008) reported significant differences in the nuclear DNA sequences and the mitochondrial genome from *L. salmonis* collected from the North Pacific versus the North Atlantic. This all has led to the conclusion that the *L. salmonis* are distinct between the North Pacific and the North Atlantic regions.

There are major reports describing large infestations of *L. salmonis* on adult Pacific salmon in coastal waters and high seas (Nagasawa *et al.* 1993; Johnson *et al.* 1996; Nagasawa 2001; Beamish *et al.* 2005; Trudel *et al.* 2007). Summary can be found in a document prepared Saksida *et al.* (2015) prepared as part of the Canadian Science Advisory Secretariat (CSAS) National peer-review meeting, Sea Lice Monitoring and Non-Chemical Measures, held in Ottawa, Ontario, September 25-27, 2012. *L. salmonis* are commonly found in high numbers on native Pacific salmon species adults. Pink (*Onchorynchus gorbaschu*) and chum (*Onchorynchus keta*) salmon are considered the 'natural' hosts for the parasite (Nagasawa 2001). Due to their preference for salmonids, *L. salmonis* infections tend to be more chronic and persistent (Integrated Pest Management Report 2003).

Development rate and survival of egg, planktonic stages and parasitic stages of *L. salmonis* are governed by temperature, for example at 2°C, 3°C, 4°C and 5°C, the hatching of nauplii takes 45.1, 35.2, 27.6, and 21.6 days, respectively, and 8.7 days at 10°C (Boxaspen and Naess 2000). The generation time of *L. salmonis* ranges from 4 weeks at 18 °C to 8-9 weeks at 6 °C (Hayward *et al.* 2011). At lower temperatures, development can stall for example moult success was reduced at 2 °C with few copepodids recovered in winter field samples from the Bay of Fundy (Hogans 1995). In British Columbia, surface (1 m) seawater temperatures range from approximately 6 °C to 13°C so cessation of development due to low temperatures is not likely. In fact, it has been suggested that water temperatures do not appear to influence sea lice abundance on salmon farms in BC (see document prepared by Jones & Johnson 2015 prepared as part of the Canadian Science Advisory Secretariat (CSAS) National peer-review meeting, Sea Lice Monitoring and Non-Chemical Measures, held in Ottawa, Ontario, September 25-27, 2012).

Studies show that survival and development of *L. salmonis* is optimal in high salinity seawater (see Jones & Johnson 2015). Sutherland *et al.* (2012) characterized the significantly elevated expression of stress-associated genes in *L. salmonis* copepodids maintained in 27‰ seawater compared with 30‰.

1.2.2 *Caligus clemensi*

The sea louse, *Caligus clemensi* (*C. clemensi*), is common as well, but to a lesser degree than *L. salmonis* (Johnson *et al.* 2004) and commonly referred to as the herring louse. *Caligus clemensi* has a broad range of hosts including Pink, Coho, Chinook, Sockeye and Atlantic salmon (*Salmo salar*) as well as rainbow trout (*O. mykiss*), non-salmonid fishes (e.g. Pacific herring (*Clupea pallasii*) and three-spine stickleback) and elasmobranchs (Parker & Margolis 1964; Beamish *et al.* 2005). Highly motile preadult and adult *Caligus* species often infect farmed salmon as preadults or adults.

Infections by *Caligus* species tend towards acute and transient (Integrated Pest Management Report 2003). The prevalence of *C. clemensi* may be underestimated by sampling due to the high motility of these animals. Spawning herring are possibly a major source of *C. clemensi* for juvenile salmon in coastal BC (Beamish *et al.* 2009). Parker and Margolis (1964) suggested that this ecto-parasite is “specific to environment rather than host” –most likely a reflection of its wide host specificity.

1.2.3 *Lepeophtheirus cuneifer*

Lepeophtheirus cuneifer (*L. cuneifer*) is much less common than *L. salmonis* and *C. clemensi* (Kabata 1974). Twelve known hosts including including rainbow trout and Atlantic salmon have been reported (Johnston & Albright 1991a). *L. cuneifer* are relatively rare (and/or possibly not recognized). Adults and pre-adults lice are highly motile.

2 What are the health effects of *Lepeophtheirus salmonis* in British Columbia?

Serious health issues associated with *L. salmonis* infestations on farmed salmon have been frequently reported by salmon farming regions located in Europe and Eastern North America, but not in Japan or on the BC and Washington State coast (Johnson *et al.* 2004). Heavy infections and damage as a result of infections with *L. salmonis* were rare in BC and aquaculture veterinarians did not consider sea lice a serious health concern (Saksida *et al.* 2007a).

This discrepancy in pathology and epidemiology was difficult to explain when the identical-looking Atlantic and Pacific varieties of *L. salmonis* were believed to be the same species. But now, genetic and physiological differences between North Atlantic and Pacific Canadian *L. salmonis* indicate they are distinct varieties. Fast *et al.* (2003) reported considerable differences in physiological reaction (higher protease activity) in Coho and Atlantic salmon as well as rainbow trout mucous when exposed to *L. salmonis* collected from BC compared to *L. salmonis* collected from New Brunswick.

Studies show that survival and development of *L. salmonis* is optimal in high salinity seawater (see Jones & Johnson 2015). Sutherland *et al.* (2012) characterized the significantly elevated expression of stress-associated genes in *L. salmonis* copepodids maintained in 27‰ seawater compared with 30‰. Perhaps some of the difference in pathogenicity between the two species of *L. salmonis* may be environment related too-- the Atlantic Ocean is saltier than the Pacific (<http://www.mbari.org/chemsensor/pteo.htm>).

3 What is the history of sea lice on salmon farms in British Columbia?

3.1 Prior to 2003

Sea lice infestations were not considered a significant fish health issue on salmon farms in BC since pathogenic lesions as described in the literature (Finstad *et al.* 2000) and observed in Europe were rarely observed in BC. Consequently, prior to 2003, enumeration of sea lice only occurred only if there were health and/or welfare concerns at a farm site. Thus treatments for sea lice infestation were rare and limited data was recorded.

However, an unexpectedly low return of Pink salmon in 2002 led to reports in scientific journals (Morton & Williams 2003) and in the popular press suggesting that sea lice from Atlantic salmon farms were negatively impacting juvenile wild Pink salmon and, in turn, affecting wild salmon returns. Salmon farms in the Broughton Archipelago were singled out (farms in this area contributed 35-39% of total farmed Atlantic salmon production in BC between 2000 and 2006).

3.2 From 2003 – 2010

In response to these claims, the provincial government instituted stringent sea lice monitoring systems and control measures on salmon farms (Saksida *et al.* 2007a). In March 2003, routine sea lice monitoring began on Atlantic salmon farms in the Broughton Archipelago (originally as part of the Broughton Archipelago Sea Lice Action Plan).

In October 2003, the monitoring program in the Broughton Archipelago was expanded to include all British Columbia salmon farms as part of a provincial management plan known as the Sea Lice Management Strategy. This was done to collect knowledge of the sea lice situation in all areas in case other concerns were raised.

The Sea Lice Management Strategy used the similar structure to the Fish Health Monitoring Program which had been running since 2001. The BC coast line is divided into zones:

- Boundaries follow major drainages or watersheds.

- Entire BC coastline (including Vancouver Island) is divided into 10 zones.
- Farms are contained in 7 of these zones.

The Sea Lice Management Strategy stipulated that during the period of juvenile Pink salmon migration out of the nearshore (March to July) ('critical' period), *L. salmonis* were to be maintained below 3 motile lice per fish (including all preadult and adult males and female *L. salmonis* stages). If *L. salmonis* levels exceed this threshold during March to July, the farmed fish had to be treated with medicant or be harvested. This threshold was lower than that prescribed in Norway at that time (6 motile *L. salmonis*) (Heusch *et al.* 2005). Management options during the rest of the year remained at the discretion of the farmer and attending veterinarian.

The threshold of 3 motile *L. salmonis* was not based on scientific evidence. It was selected by government and industry as a level that would allow precautionary management while more scientific data were gathered to better inform the issue. It acknowledged both: the lack of serious sea lice disease occurring in BC farmed salmon compared to other global jurisdictions with *L. salmonis*, and the large populations of wild salmon in BC that are known to carry sea lice and thus greatly influence the sea lice abundance on farmed salmon, particularly during the summer to fall return migration season.

As part of the monitoring program implemented in October 2003, farms growing Atlantic salmon in BC were required to report sea lice data into a database. This involved compulsory reporting of the abundance of chalimus and motile stages (preadult and adult stages) of *C. clemensi* and *L. salmonis* on a monthly basis. Monitoring and reporting of sea lice data on a farm begins as soon as one month has passed following the entry of the third pen of smolts; reporting could stop when less than three pens remain during harvest. The mandatory reporting could be interrupted in the event of sea lice treatment, other fish health events, or environmental problems, such as low dissolved oxygen.

The protocol for monitoring sea lice on salmon farms required that three pens (20 fish per pen) be assessed. Sampled pens included one index pen, that was the first pen populated in the system, and two "randomly" selected pens per sample period. Farms growing Pacific salmon are required to monitor and report sea lice information less frequently: thirty fish per farm on a quarterly basis.

For assessment, fish were most often sedated in totes and examined for sea lice (totes are examined for lice as well). Motile stages of *L. salmonis* and *C. clemensi* are identified and counted. Attached stages (copepodid and chalimus stages) were counted also, but species determination is not required.

The farms reported counts to a central database owned by the British Columbia Salmon Farmers Association, and monthly reports summarizing sea lice abundance for motile *L. salmonis*, adult female *L. salmonis* and motile *C. clemensi* by zone are provided to the British Columbia Ministry of Agriculture and Lands.

In addition to farm reporting of lice levels the provincial government also had an audit program. Government Fish Health Technicians conducted sea lice audits:

- 25% of active farms audited between July and March
- 50% of active farms audited between March and July

For each pen, 10 fish examined by farm staff, 10 by government technicians. The values were compared for agreement.

These monthly sea lice abundance data summaries were made available to the public through the government website. Annual reports were created to provide a summary and interpretation of the finding of the program including the audit program. Therapeutant volumes were also reported in the annual report.

3.3 Since 2010

In 2010, Fisheries and Oceans Canada (DFO) took over full management of aquaculture (<http://www.dfo-mpo.gc.ca/media/back-fiche/2014/hq-ac06b-eng.htm>). During the transition period between authorities, sea lice audits as well as Fish Health Audits were conducted by a third party research facility (BC Centre for Aquatic Health) to maintain continuity of the data as the DFO program was still under development. Audit program by DFO started in the second quarter of 2011 (Table 1).

Threshold levels, monitoring and audit programs remained similar to the provincial governments. However farms now were required to report sea lice levels directly to the department. Data posted on the DFO website included individual farm data, and audit data for the farm if applicable – chalimus data (unspiciated was also now included) as well as if farm was treating or harvesting rather than by zone. No further annual reports with interpretation, description of trends and changes were prepared.

4 What are the key findings from the sea lice audit program?

Table 1 summarizes the number of audits done. Audits conducted between 2004 and 2009 found that in 93% of the assessments, there was no statistical difference (at 5% error) in the assessment for motile *L. salmonis* and adult female *L. salmonis* between the farm personnel and the government auditors (BC MAL Annual Reports 2003-2005, 2006, 2007, 2008) indicating that lice were properly identified and enumerated by farm personnel. More importantly, the audit program is used to verify the accuracy of the sea lice data that industry provides to the provincial government on a monthly basis.

Table 1 number of Atlantic salmon farms audited by BCMAL (light gray shading), BC CAHS (no shading) and DFO (dark gray shading) during each quarter: Q1- Jan-Mar, Q2- Apr-Jun, Q3- Jul-Sep, Q4- Oct-Dec.

Year	# Farms Audited for Sea Lice			
	Q1	Q2	Q3	Q4
2004	8	7	11	10
2005	12	25	9	7
2006	9	25	7	6
2007	7	12	2	5
2008	12	30	16	13
2009	14	30	15	15
2010	15	16	15	13
2011	16	15	7	13
2012	12	19	4	6
2013	6	19	6	6
2014	5	20	6	4
2015	6	28	5	6

Assessment of the audit program since DFO took over the program in 2011 found 100% agreement with farm counts between 2011 and 2014. In 2015 (Q1-Q3) however agreement dropped to 85% with the most of the differences in counts observed in Q2. During this quarter, on 3 of 4 farms, significantly higher counts in motile *L. salmonis* were achieved by auditors in comparison to the farmers; on the other farm; the farmers had significantly higher numbers. But in all situations if auditors achieved a mean motile *L. salmonis* count of 3 or greater so did the farms.

5 What are the general findings from monitoring sea lice on salmon farms?

5.1 General findings regarding sea lice on farmed Pacific salmon

Both Chinook and Coho salmon are farmed in British Columbia although at a far smaller scale than Atlantic salmon. Sea lice assessment and reporting requirements on farmed Pacific salmon is less stringent than in the case for farmed Atlantic salmon. Assessments are less frequent and carried out on fewer fish. This was done since Pacific salmon do not deal well with crowding and handling. It can lead to an increase prevalence of diseases such as BKD, or even death due to the handling stress.

Saksida *et al.* (2006) examined the sea lice data collected from farmed Pacific salmon. During the spring, when lice on the farms were to be maintained below three motile *L. salmonis*, the mean abundance reported on farms with Pacific salmon was 0.7. Even without treatment, lice levels on farmed Pacific salmon were maintained at levels equal to or below those observed on farmed Atlantic salmon. Similarly, Ho & Nagasawa (2001) reported that coho salmon farmed in Japan had substantially lower sea lice levels than farmed rainbow trout.

5.2 General findings regarding sea lice on farmed Atlantic salmon

Farms have been routinely reporting sea lice data to DFO since the establishment of the program with the exception of May to October 2012 when routine monitoring was halted due to IHNv detection on some Atlantic salmon farms.

Both *L. salmonis* and *C. clemensi* are found on farmed Atlantic salmon in BC (Figure 1). Motile *L. salmonis* levels on farmed Atlantic salmon tend to fluctuate both temporally and spatially. Motile *L. salmonis* levels generally increase as time spent in sea water increases. This trend has been reported in both wild and cultured salmon and was likely attributable to increased length of exposure (Nagasawa 1985; Bron *et al.* 1991; Tully & Nolan 2002; Revie *et al.* 2002b; Heuch *et al.* 2003; Trudel *et al.* 2007). Saksida *et al.* (2006) reported that levels of *L. salmonis* on Atlantic salmon after more than one year in sea water were 2.5 times higher than those on salmon having spent less than one year in sea water.

Seasonal variation of *L. salmonis* is also evident on farmed salmon. With very few exceptions, *L. salmonis* levels increase in the autumn on farmed Atlantic salmon in British Columbia (Saksida *et al.* 2006, 2007a,b). The lowest sea lice levels are most frequently reported in the summer. Beamish *et al.* (2006) reported that, in one region, prevalence of sea lice infected farmed Atlantic salmon ranged from 85% in February to 46% in August and that the intensity of all lice stages on fish was highest in February (21 lice per fish) and lowest in July (3.3 lice per fish). Orr (2007) looked at gravid female lice levels to estimate egg production from selected farms located in the Broughton Archipelago during 2003/4. He estimated that maximum egg production occurred during November and December and that by January/February

egg production was down by 50%. By March/April, egg production was down to 6% of the maximum estimated levels.

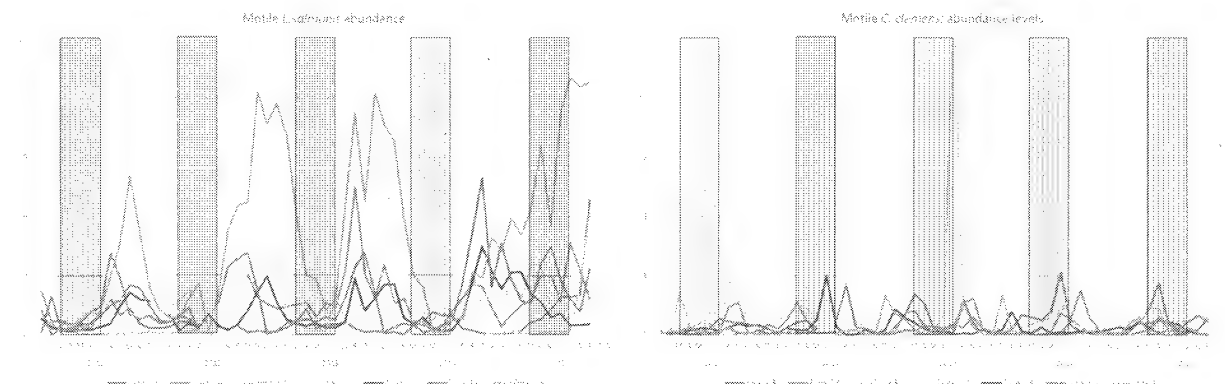


Figure 1 shows the mean motile *L. salmonis* (left) and *C. clemensi* (right) on all farmed salmon and from 2011.

The increase in lice abundance on farmed salmon in the autumn is associated with the return of adult Pacific salmon to their natal rivers (Saksida *et al.* 2006, 2007a; Beamish *et al.* 2005, Marty *et al.* 2010). Direct transfer of motile stages has been reported to occur in situations where host densities are high such as within salmon farms in Europe (Ritchie 1997; Tully & Nolan 2002) and from wild to farmed salmonids in Japan (Ho & Nagasawa 2001).

There is considerable variation in abundance between the fish health zones (Figure 1). It has been suggested that the variation in lice abundance between the different farming regions may be partly related both to the species of wild salmon found in a zone and to their respective abundances (Saksida *et al.* 2006; Jones *et al.* 2006a). Another source of variation in lice abundance between the different farming regions may be *L. salmonis* in the Pacific Ocean have been reported on non-salmonid hosts such as the three-spine stickleback (Jones *et al.* 2006a). The role that these alternate species may play in the natural infestation patterns of sea lice on wild and farmed salmon has not been determined as yet.

Observed regional differences may be linked to environmental factors including differences in temperature and salinity, or to local hydrography (Jones *et al.* 2006a). For example, regions with the highest salinity reported the highest sea lice abundance levels (Saksida *et al.* 2006, 2007a, Elmoslemany *et al.* 2015). Laboratory studies have confirmed associations of environmental factors and lice abundance and in British Columbia there are differences in environmental factors between salmon farming regions or zones.

Changes in salinity and temperature have been reported to affect *L. salmonis* survival and growth rates. Johnson and Albright (1991b) reported that, at salinities of 20 and 25mg/l, the majority of active nauplii died at the copepodid moult stage. Active copepodids were only obtained at 30mg/l. Salinity patterns vary considerably among the different BC regions: for instance, both the west coast regions as well as the Broughton region show annual variation in surface (0-1 m) salinity with the seasons of lowest salinity being reverse to one another. Farms on the west coast of Vancouver Island report lowest levels of salinity in the winter and highest in the summer with a mean difference of 4mg/L (23-27mg/l) (Saksida *et al.* 2006). It has been proposed that the variation may be associated with precipitation, which is

especially high during the fall and winter. Conversely, farms situated in the Broughton Archipelago report highest salinity levels in the winter and lowest in the summer with mean differences of almost 6mg/L reported (range 29-23mg/L)(Saksida *et al.* 2006). The freshwater run-off from snowmelt which occurs in the summer, reduces surface salinity (Foreman *et al.* 2006; Saksida *et al.* 2006, 2007a, b; Beamish *et al.* 2006).

There are significant differences in the primary hydrographic transport mechanisms among the different farming regions in BC likely important in the movement of the plankton stages of sea lice. The primary hydrographic transport mechanisms in the Broughton Archipelago are estuarine flows resulting from considerable river and glacier melt runoff and wind (Foreman *et al.* 2006). These influences were particularly strong in the inlets of the region especially during the summer months when river flow was at its maximum. Wind driven circulation likely plays a significant role in sea lice dispersion (Asplin *et al.* 1999; Murray & Gillibrand 2006). In contrast, the primary hydrographic transport mechanism in the Discovery Islands is tidal with little wind effect (Foreman *et al.* 2012). The significance of these factors around the salmon farms in BC is still not well understood (Rees *et al.* 2015).

Caligus clemensi tends to be the less common (often by many numerical factors) sea louse species occurring on farmed Atlantic salmon (Figure 1), with higher abundance levels occurring in younger farmed salmon populations. *Caligus clemensi* levels show inter-annual variation though there did not appear to be consistent inter-seasonal variation (Saksida *et al.* 2007a). These findings are similar to reports of infestation with *C. elongatus* in Scotland where higher abundance levels were seen in younger salmon populations but differ in that the authors noted consistent levels from year to year (Revie *et al.* 2002a; McKenzie *et al.* 2004). Regional differences in abundance levels of *C. clemensi* between farming regions in BC have been observed.

5.4 How has compliance to the 3 motile *L. salmonis* threshold during the suggested “critical” period (March to July) been?

From 2011 to 2014, there was approximately 95% compliance of farms maintaining levels below 3 motile *L. salmonis* during the ‘critical’ period. However in 2015, there was a decrease in compliance to 76%. Twenty-six farms reported levels equal or great than 3 motile *L. salmonis* in at least one month between March and July. This occurred in all zones except for 3.1. The last time a similar event was observed was in 2004 (Figure 2).

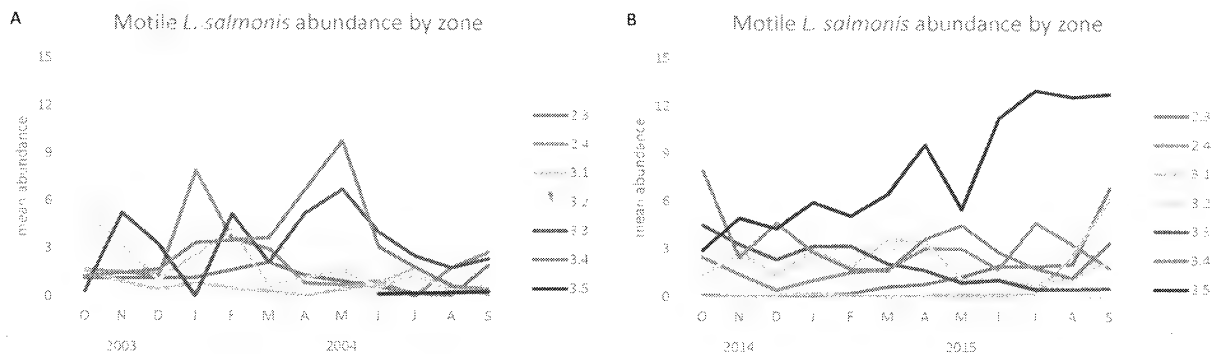


Figure 2 shows the motile *L. salmonis* abundance by zone for the periods October to September 2003/4(A) and 2014/15 (B).

5.4.1 How does 2014/2015 compare to 2003/04?

The higher than expected motile *L. salmonis* thresholds observed in the spring 2015 in six farming regions, although unusual to most years, was similar to events observed in the same period in 2004 (Figure 3). In 2004 there were two regions affected: Broughton (farms in zone 3.3 and 3.4) and the West Coast of Vancouver Island (zone 2.4). Marty *et al.* (2010) reported that Spring 2004 had the largest total number of adult sea lice on all farms in the Broughton Archipelago in their 10 year study.

More regions appear to have been affected in the 2014/15 event however it should be pointed out that in 2003/04, many regions were in the midst of cleaning up following the IHNV outbreak (2001-2003) and as a result many farms were fallow in Tofino and Port Hardy during this period. In the Discovery Island region, companies had switched to Chinook salmon for one rotation. In Klemtu, many of the farms were still rearing Chinook salmon although the switch to Atlantic salmon had started.

When lice data from individual farms are compared, it becomes apparent that the abundance of *L. salmonis* was higher in the 2004 than 2015 for the affected farms in both the west coast Vancouver Island and the Broughton Archipelago (Figure 3). The period where the elevation numbers were observed however appears to be similar between the years.

The cause of this unusual event is unknown though both climatic (precipitation, temperature, salinity) and/or biological (spike in an unknown host) factors have been suggested. For instance 2014/15 had low rain fall and winter snow packs. Higher salinity and water temperature have been shown to

improve louse survival and rate of development. This may have improved overwintering survival of the lice.

It has also been suggested that high number of returning adult salmon may have also played a role, this however would have to be further investigated. In 2004, the spring spike in *L. salmonis* observed was despite a fairly low return of Pinks salmon into the Broughton Archipelago in 2003 (Figure 4) but the odd-year Pink salmon run to the Fraser River was exceptional. In fact the Pacific Salmon Commission estimated the amount of Pink salmon returning to the Fraser River in 2003 was 26,000,000: largest Pink salmon escapement since 1959. Conversely the 2014 spike was associated with moderate to good Pink salmon escapement to the Broughton Archipelago (Figure 4) and no Pink salmon returning to the Fraser River (no even year stocks). Interestingly, even though lice numbers on farms and juvenile Pink salmon (Jones & Hargreaves 2007) were elevated in the spring of 2004, the subsequent return of these populations as adults (2005) was better than their parents (2003) (Figure 4) (Van Will 2015).

Pink salmon are also unlikely the cause for the spike observed on the west coast (zones 2.3, 2.4) as there are few to no Pink salmon runs in the area.

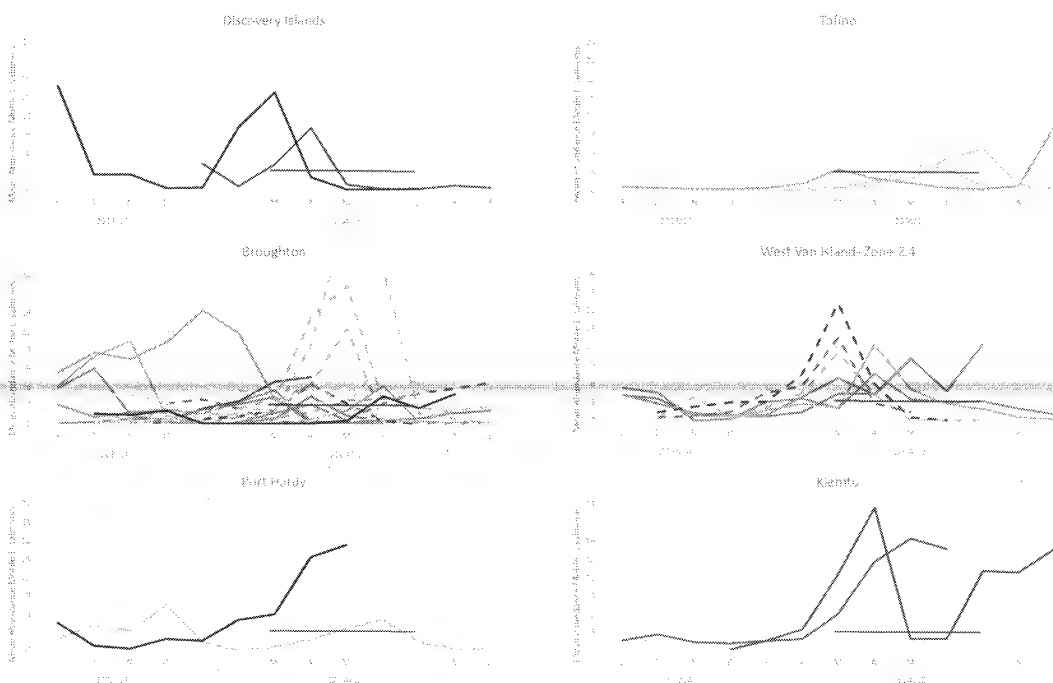


Figure 3 shows the mean motile *L. salmonis* abundance by farm that reported thresholds levels above 3 motile lice during the critical period (March to July) in 2004 (dashed lines) and 2015 (solid lines) for each zone. Note no farms were over threshold in zone 3.1.

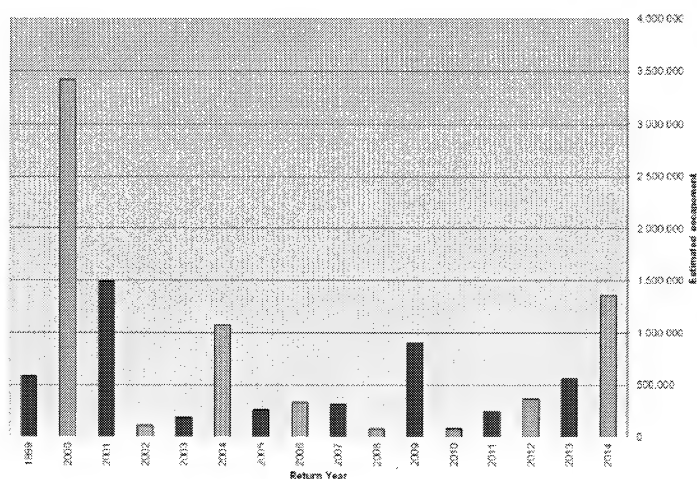


Figure 4 Estimated escapement of adult Pink Salmon returning to Broughton Archipelago Rivers.

5.5 What can be said about sea lice treatment in British Columbia?

SLICE® became available to veterinarians under special permit, called an emergency drug release or EDR, obtained from Health Canada in December 2009 and gained full registration approval in July 2009 with a recommended withdrawal period of zero days, though the industry continues to apply longer withdrawal periods.

SLICE® became the only therapeutic used for sea lice treatment in British Columbia. A concern for the BC salmon farming industry has been the inherent limitation of having only one sea lice treatment product available for use. This differs from other agricultural industries which utilize integrated pest management, (a rotation of treatments) to prevent or delay development of resistance in a pathogen.

There was an increase in use of SLICE® since the introduction of the threshold limits with quantities in 2005 reporting levels over 2.5 times greater than levels that existed prior to implementation of the BC Sea Lice Management Strategy in 2003 (Figure 5). Peak use of SLICE occurred in 2005, 2010 and 2011 (~0.26 g/ metric ton (MT) of salmon produced). Usage other times as been at or below 0.2 g/ MT.

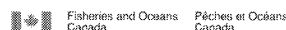
The total number of SLICE® treatments for Atlantic salmon ranged from zero to three per production cycle (i.e. smolt entry to harvest) (Saksida *et al.* 2006, 2007a). Additional data reported in Saksida *et al.* (2010) suggest that frequency of treatment has not changed over the first five years since the establishment of the maximum threshold levels.

Concerns regarding SLICE® treatment failures, reduced sensitivity and/or potential resistance have been confirmed in Scotland, Ireland, Chile and Norway (Lees *et al.* 2008a,b; O'Donohoe *et al.* 2008; Bravo *et al.* 2008; Aaen *et al.* 2015). Saksida *et al.* (2010) conducted a similar analysis with data collected from farms in British Columbia from 2003 to 2008 and found that there has been no change in the efficacy of the emamectin benzoate's (EMB, active ingredient of SLICE®) apparent duration of effect. Treatment

efficacy and EMB bioassays also suggested that sea lice continued to be susceptible to the product (Saksida *et al.* 2010; Saksida *et al.* 2013) although regional differences are seen.

A recent modelling study has demonstrated that the presence of a large un-treated 'refugia' of wild fish should indeed likely retard the development of tolerance within sea lice populations (McEwan *et al.* 2015). However, increasing the number of treatments per cycle, one consequence of adopting a reduced sea lice threshold, is one of the key drivers of selection for resistance. There is evidence to suggest that tolerance can build even after three treatments and more rapidly in adult male than female sea lice. This may be because males are more motile – capable of more easily swimming off the host and reattaching than females. Alternatively males are hardier as they need to expend less energy in reproduction.

Evidence of tolerance have now been observed and as a consequence Hydrogen Peroxide bath treatments, under an Emergency Registration from the Pest Management Regulation Agency (PMRA), have been used four times in BC (in 2014 and 2015). Treatment successfully reduced sea lice on the affected farms (in zones 2.4 and 3.5). This exemplifies the need a re-evaluate of the current regulations and ensure appropriate management of sea lice and avoid unnecessary treatments which could lead to resistance or have impacts on non-target organisms.



**Use of in-feed anti-lice therapeutants in B.C.
salmon aquaculture 1996 - 2012**

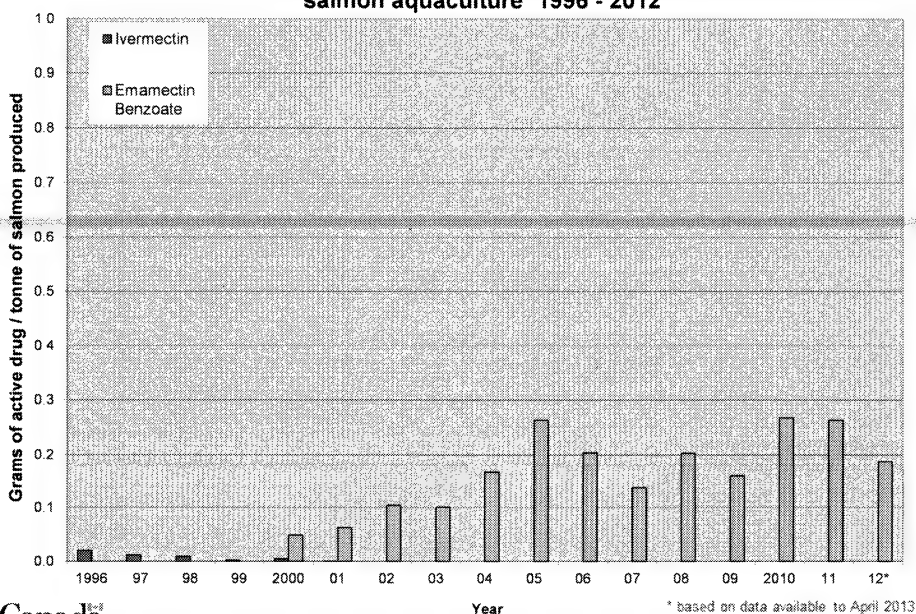


Figure 5 anti- parasitic use by BC aquaculture.

6 What have we learned about sea lice and wild juvenile Pacific salmon in the last decade?

6.1 On individual salmon

Sea lice have also been reported on all species of juvenile salmon in the marine environment and vary among species (fish and louse species), by geographic location, environment, length of time in seawater and annually (Trudel *et al.* 2007, Rees *et al.* 2015, Elmoslemany *et al.* 2015) (see Saksida *et al.* 2015 for summary). Sea lice have been reported on juvenile Pink and Chum salmon shortly after emergence from the river into the marine environment as small as 0.2g. Preponderance of *L. salmonis* versus *C. clemensi* varied spatially and temporally (Patanasatienkul *et al.* 2015).

Caligus clemensi was reported to be the predominant louse species on juvenile Sockeye salmon in the Discovery Islands and north coast in a 2 year study (Price *et al.* 2011) and Southern Gulf Islands (Beamish *et al.* 2009); while in one area of the west coast of Vancouver Island fish were almost exclusively infested with *L. salmonis* (Elmoslemany *et al.* 2015).

A considerable amount of research has centered around the health implications of sea lice on individual juvenile salmon particularly Pink salmon. There appears to be now consensus of minor skin lesions associated with sea lice attachment on naturally infected Pink and Chum salmon (Saksida *et al.* 2012, Jakob *et al.* 2013) and the bleeding at the base of the fins noted in Morton & Routledge (2005) was not in fact associated with sea lice but more likely the associated with stressful environmental conditions or bacterial and viral infections in the wild captured juvenile salmon (Marty *et al.* 2010). However Sockeye salmon when exposed to high levels of adult *L. salmonis* in controlled laboratory trials did exhibit signs of epithelial grazing and parasite-induced damage were not observed on Coho or Atlantic salmon (Branden *et al.* 2014).

The presence of sea lice does not hinder swimming performance in Pink salmon (Nendick *et al.* 2011). A 'no effect' threshold for sublethal disturbance has been reported to as 0.5 g with one chalimus 4 is consistent with the developmental stage at which Pink salmon develop scales and exhibit a heightened immunocompetence (Sackville *et al.* 2011; Brauer *et al.* 2012). Furthermore controlled laboratory studies found the lethal level for Pink salmon weighing less than 0.7g to be 7.5 *L. salmonis*/g. Above this size Pink salmon appear to be highly resistant to lice (Jones *et al.* 2008) though they do appear to become more sensitive upon sexual maturity (Braden *et al.* 2014).

Naturally infected juvenile chum salmon had higher intensities of infection with *L. salmonis* compared with Pink salmon (Jones & Hargeaves 2007, 2009). The latter pattern was repeated in laboratory exposures in which the parasite was rapidly rejected from juvenile Pink compared with juvenile Chum salmon (Jones *et al.* 2006b, 2007). The consensus is that juvenile chum salmon and Atlantic salmon are more susceptible to *L. salmonis* than Pink salmon (Sutherland *et al.* 2014).

Pink salmon and Coho salmon have been found to reject sea lice (*L. salmonis*) at higher rates than chum, Chinook and Sockeye salmon (Jakob *et al.* 2013). *L. salmonis* mature more slowly on Coho salmon than on rainbow trout or Atlantic salmon and concluded that Coho salmon had a relatively high innate

immunity to *L. salmonis* (Johnson & Albright 1992); Fast *et al.* 2002) and therefore would likely not to be negatively impacted when preying on juvenile salmon carrying lice as suggested by Connors *et al.* (2010).

In summation studies have demonstrated that juvenile Pink and Coho salmon are the most resistant to *L. salmonis* while Sockeye, Chum and Atlantic salmon are less so. Chinook salmon tolerance to *L. salmonis* is situated somewhere in between these two groups.

6.2 On a population scale

Considerable research has also centered around population level effects of sea lice and there continues to be two distinct opinions.

One group suggested that as much as that 90% of Pink and Chum salmon in the Broughton Archipelago were infected at or above lethal limit which they suggested were 1.6 mobile lice/g (Morton *et al.* 2004) and inappropriately forecasting the extinction of Pink salmon populations in the Broughton Archipelago (Krkošek *et al.* 2007). Some criticized the reports based on them attributed population level declines on evidence of association not causation, using a flawed mortality study (Morton *et al.* 2004) to calculate mortality rates and often did not differentiate sea lice species (Morton *et al.* 2004, 2011; Krkošek *et al.* 2005, 2006a,b, 2007) or compare areas that were very different from one another (Ford & Meyers 2008). Several of the same authors who had predicted a collapse of wild Pink stocks later published a report indicating that survival of Pink salmon stocks in the Broughton Archipelago did not statistically differ from a reference region without farms (Morton *et al.* 2011) and suggested that winter treatments on farmed fish for sea lice and following the current threshold criteria lead to lower lice abundance on out-migrating juvenile wild Pink and Chum salmon in the Broughton Archipelago (Peacock *et al.* 2013). Suggesting that perhaps the sea lice program at its current state was in fact effective for the Broughton Archipelago.

Other researchers however incorporated results from published controlled lab study results into their analysis and suggested that *L. salmonis* induced mortality ranged from 0 to 4.5% for the same periods reported above, leading these authors to conclude that sea lice related mortality contributed only minimally to the overall mortality normally experienced during this life-stage (55-77%) of Pink salmon (Jones & Hargreaves 2009). Marty *et al.* (2010) reported that the number of Pink salmon returning to spawn in the fall predicts the number of female *L. salmonis* on farms in the next spring and in turn accounts for 98% of the variation in sea lice prevalence seen in the out-migrating juvenile salmon in the Broughton Archipelago. Suggesting the higher the return numbers of the Parent population, the higher the lice levels on corresponding juvenile offspring of Pink salmon during their outmigration but there is no correlation with lice levels of on the juvenile salmon and their subsequent return levels as adults (i.e. population survival rate). This research suggests that sea lice at current levels (including those seen in 2004) may not be affecting Pink salmon populations in the Broughton Archipelago.

7 What have we learned about alternative hosts for sea lice?

Three-spine stickleback, a very abundant nearshore species in British Columbia have been found to host *L. salmonis* to the pre-adult stage (Jones *et al.* 2006a, Jones & Prosperi-Porta 2011). Pert *et al.* (2009) suggested successful settlement and feeding on non-salmonids allowed *L. salmonis* to use other species as peripatetic (or paratenic / transport hosts) to improve survival and to aid dispersion until a salmonid host is encountered.

Many non-salmonids are commonly known to host *C. clemensi* particularly Pacific herring and three-spine stickleback. They may act as a year-round reservoir for this species of louse.

8 What can we say about the salmon and sea lice in BC?

The ratio of wild adult salmon to farmed salmon in British Columbia is ~ 1000:1 (Saksida *et al.* 2015). The ratio of wild juvenile salmon (smolts) to farmed salmon must be significantly higher since as estimated survival rates (smolt to adult) range from 0.7% for Chum to 9.8% for Coho (Bradford 1995). Sea lice and fishes co-evolved, so infestations in wild salmonid and non-salmonid fishes are a natural phenomenon. Transmission of sea lice between and within wild fish populations and salmon farms occurs, however, the dynamics of transmission will depend on a multitude of environmental and biological factors, and will be site and time-dependent. Sea lice dynamics (i.e., development and survival) are influenced by salinity and water temperature (which affect survival, growth, development rate, and reproductive success of sea lice), water movement (tides and currents), behaviour of infective larval stages and motile pre-adult and adult stages, and the abundance and proximity of suitable fish hosts.

9 What can we say about the sea lice monitoring program?

Sea lice monitoring programs currently in use in BC for both farmed and wild fish have demonstrated that farming regions in BC vary in both ecology and environment and existing program may not be appropriate for all areas. The original program was to address specific concerns in one farming region; specifically what lice sea from farms operating in the Broughton Archipelago could be having on juvenile Pink (and to a less degree Chum) salmon during their out-migration. The program was designed using precautionary principles to address this concern while research on topic could occur. This program was then expanded to all the other farming regions without any acknowledgement of environmental and biological differences between areas (i.e. temperature/salinity differences, hydrography, wild salmon species present, migration timing). Now that there is more understanding of the affects that lice have on the different species of wild Pacific salmon, the period of risk it is perhaps time to re-evaluate and re-

develop the program. It is possible that the thresholds, the critical period and the reporting scheme may actually have contributed in tolerance issues developing in certain farming areas.

The program and its objectives need to be re-evaluated and revised based on the data that has been collected. It must be noted that any sea lice monitoring and management program should be for *L. salmonis* alone since salmon are the predominant host for this species of louse.

The results from the sea lice program has demonstrated the importance of integrated pest management programs (IPM) as part of ensuring success of a health management program. When the program was established there was only one therapeutant registered for use for the treatment of sea lice. After 12 years there continues to be only one registered product. Establishing mandatory treatment thresholds, across all the regions, without providing options to rotate products could have resulted in the tolerances that are starting to be seen in some regions. In these areas hydrogen peroxide has been made available but requires an Emergency Release for results in treatment delays. Any management program should include IPM options. And as long as there are applied thresholds and critical periods, DFO should support the use of other products to ensure that resistance does not become a wide spread problem

The current policy of reporting of raw data without context is also a concern. Annual reports with interpretation were no longer prepared. Reporting individual farm data to public with no interpretation may not be helpful to the program. The current policy of reporting farm level data may actually be having a potential a negative impact on health management on farms. DFO should also prepare papers for publication of the data collected.

Current the department operates an audit program on a year round basis. This component of the program is likely cost. The department may want to investigate in targeting program to the 'critical' periods. The department may want to set up a sea lice training program for the farmers if there is a concern with identification.

Aquaculture management policy of managing farms to peak biomass rather than total production and also allowing for farms to increase production in lieu of opening up new tenures may be altering the sea lice dynamics with an area and affecting long term management capabilities. Furthermore it is possible that using the peak biomass may result in more fish staying in the water for a longer period. And as the data has shown, lice abundance increases with length of time in seawater.

Finally, the sea lice data has shown that farms could act at a sentinel to study what is going on in the surrounding environment – e.g. high *L. salmonis* in the fall suggests good wild salmon returns, high *C. clemensi* could indicate an abundance of herring or some other natural host for this louse species. This could play an important role in determining locations for new farming licenses.

9.1 What are the objective of the sea lice program in BC?

There are two possible objectives for the current program in British Columbia

9.1.1 To protect wild juvenile salmon during their outmigration

The initial program was designed to 'protect' juvenile Pink (and Chum salmon) from sea lice (specifically *L. salmonis*) from farms in the Broughton Archipelago. Timelines and thresholds were then expanded to other regions.

Has this objective been achieved? For what species? How is success measured? What is the benchmark for this?

9.1.2 To provide public confidence that sea lice are being appropriately managed on farmed salmon in BC

Initially, under the province, program rolled up the data to zones, zone level sea lice data was published on the website. Summary and interpretation of the results (including fish health), including audit data compliance was provided in an annual report.

Once under DFO control – farm level data was posted on the website, with no interpretation or summation.

Has this objective been achieved? Probably not. The program results have not been well communicated. The raw data without any context or interpretation simply allows for those opposed to cherry pick data and interpret data. For example by showing individual farm data – the high lice levels seen in the autumn may provide an impression of mismanagement of the issues.

9.2 What are some options for the program going forward?

It would be strongly recommended that a panel of experts be convened which include veterinarians, DFO biologists, Stock assessment specialists and oceanographers to develop the framework for a new program. Listed below are a few options to consider; this however is not an exhaustive.

9.2.1 Disband the program

9.2.2 Maintain existing program as is

Current program is expensive and based on research it should be redesigned to provide service to both the public and the ecosystem.

9.2.3 Maintain present threshold but only during critical time of juvenile out migration

The rest of the year farms are allowed to manage based on their own health needs.

Science questions

For each area what are the species of interest? And when are they susceptible?

What is the timing of their migration? What is the critical period? How much variability is there in the timing?

Is there a way to predict a change in emergence in advance to be able provide farms enough time to meet the threshold at the appropriate time? It maybe science could provide a forecast as these periods would likely vary based on climatic influences (does DFO science have this kind of information?) Could it be collected if not?

Management questions

Has there been a shift in treatment timing since the onset of farm level reporting?

Advantage

- Farm level management maintained
- Fish that migrate past one farm will have equal probability of being exposed to a similar number of lice than fish migrating past another farm. (i.e. 3 motile/fish or less)
- Program continuity is maintained (for the period of concern)
- Audit program could just occur during period of interest.

Disadvantage

- May have to establish new siting criteria. Restrict increase biomass on sites that have issues with sea lice management. Restrict new sites in areas where lice management difficult

9.2.4 Establish maximum lice numbers thresholds for farms during critical periods.

For example standard farm has 500,000 fish and currently maximum number of lice per fish must not exceed 3 motile lice (or 1.5 Million motile lice/ farm) (Table 2).

Table 2 shows an example of the number of lice permitted on farm based on using a total motile sea lice threshold

Number of fish on farm	Abundance of motile <i>L.salmonis</i>	Number of lice/farm	Comment
500,000	3	1,500,000	maximum allowable during outmigration period for a farm
250,000	6	1,500,000	if harvesting # can increase as long as still maintain below the 1.5 million lice
750,000	2	1,500,000	if farm has more fish than the number of lice per fish is reduced

Science questions (in addition to those listed in 9.3.3)

What is a reasonable threshold for farms within each area?

Management questions

How will the new program be monitored/audited/reported to ensure accuracy in production numbers?

Advantage

- May require less therapeutant use since farms harvesting may be able to maintain total threshold just by harvesting.
- Farms with larger number of fish are usually holding smolts which have fewer lice.

Disadvantage

- Will need to develop mechanisms to ensure accuracy in production numbers
- Will need to modify how data areas reported and broadcasted.

9.2.5 Switch to Area Management rather than Farm-level management.

An argument could be made that a better model for a threshold could be establishing a threshold for a specified area/region (either based on lice levels or biomass) rather than a per farm limit (see table 3).

This could result in a more prudent use of the therapeutant and overall better management of an area.

Table 3 illustrates change in treatment requirements if area based management was implemented rather than by farm thresholds

Area consisting of 3 farms	No. of fish on a farm	Average size of fish (kg)	Abundance of motile <i>L. salmonis</i>	Scenario 1 – current farm level threshold	Scenario 2 – area based thresholds (3/fish/area) - now abundance only 1.7/fish/area
1	500,000	5	3	Treatment required	no tx required
2	500,000	1	1	no tx required	no tx required
3	500,000	1	1	no tx required	no tx required

Science questions (in addition to those outlined in 9.3.3).

What are these areas?

Will there be areas for different diseases?

What is the threshold lice level for the area?

What is the maximum number of farms (fish) within an area? (Capacity)

Management questions

How will the new program be monitored/audited/reported?

Advantage

- May require less treatment to maintain area threshold
- Audit program could be adjusted so areas are selected for audit not farms – could mean less travel. This program could target period of interest.

Disadvantage

- There could be farms with greater than 3 motile/fish
- Increase risk for fish that swim past or downstream of farms with great than 3 motile lice/fish
- May have to establish new siting criteria. Restrict increase biomass on sites that have issues with sea lice management. Restrict new sites in areas where lice management difficult
- Reporting and compliance offences may need to be modified.

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ⁱ Active farm is on with salmon populations in seawater for greater than 1 month. Did not include broodstock farms.

Delaney, Paula

From: Lavigne, Lauren
Sent: May-01-18 1:00 PM
To: Campbell, John P.; Medeiros, Dean
Cc: Webb, Allison; McCorquodale, Brenda; Paylor, Adrienne
Subject: Integrated Pest Management
Attachments: SEA LICE Statement of Knowledge Dec 22_15.docx; Integrated Pest Management_FAIAIP_July21,2017.pdf

Hello!

As promised, attached are two documents that might help with the IPM contract.

Thanks,

Lauren

**Pages 496 to / à 526
are duplicates of
sont des duplicatas des
pages 464 to / à 494**

Report of the DFO-Industry Marine Finfish
Strategic Working Group (SWG) to the
Finfish Aquaculture Industry Advisory Panel
(FAIAP) on:

Integrated Pest Management Approach to
Sea Lice Management for BC Atlantic
Salmon Aquaculture Facilities

July 14, 2017

FINAL DRAFT FOR REVIEW

Integrated Pest Management Approach to Sea Lice Management for BC Atlantic Salmon Aquaculture Facilities

Overview

The Atlantic-salmon farming sector in British Columbia and the Fisheries and Oceans Canada (DFO) recognize the urgent need to develop and implement a comprehensive Integrated Pest Management (IPM) strategy for sea lice. An IPM strategy will assist in meeting DFO management objectives for wild and farmed fish and will enable salmon farmers to manage sea lice in the best interest of animal welfare and productivity.

Currently, in British Columbia, sea lice management options are limited and the majority of farms rely on a single therapeutant, emamectin benzoate, to manage sea lice levels on farmed fish. There is a real concern that this treatment will become ineffective with continued consecutive use, as has occurred in other salmon regions worldwide.

IPM is founded on a commitment to continual improvement through the development/adoption of new technology (tools), management processes and treatments as they become available. All IPM plans include: prevention, monitoring, thresholds for action, and control through a suite of management tools (physical, biological and chemical). DFO and the BC salmon farming sector agree on the essential components of an IPM strategy for BC as described in Table 1 below.

Table 1 Essential Components of Sea Lice IPM Strategy for BC

- 1** – Development of a strategic sea lice management program that promotes farmed salmon health and minimizes the effects of sea lice on both farmed salmon and wild fish.
- 2** – Optimization of sea lice treatments to achieve maximum efficacy while minimizing environmental residues and potential effects on non-target organisms.
- 3** – Reduction in resistance development to management tools by having a suite of management options available.
- 4** – Commitment to investigation, and implementation of new management tools including development of enabling permitting and use regulations.

Sea lice are naturally occurring pests that infest farmed salmon and a variety of wild fish including Pacific salmon. In British Columbia, DFO regulates sea lice levels on farmed salmon through the conditions of license for each salmon farm as a precautionary approach to ensure impacts to wild fish are minimized. Regulatory oversight includes monitoring, reporting, and setting thresholds for management action. Salmon farming veterinarians and fish health staff are responsible for sea lice management programs.

The purpose of this document is for DFO and the BC salmon farmers to convey the immediate need for a comprehensive IPM for sea lice management in British Columbia.

Integrated Pest Management Approach to Sea Lice Management for BC Atlantic Salmon Aquaculture Facilities

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This document is the result of a collaborative effort between the BC Salmon Farmers Association members and DFO Aquaculture Management under the guidance of the DFO-Industry Marine Finfish Strategic Working Group. The context is not regulatory or scientific in nature. It reflects the opinions and expertise of a range of subject matter experts (SMEs) to set out a State of Knowledge of best practice around Integrated Pest Management Approaches for Marine Finfish Aquaculture.

Sea Lice in British Columbia

Two main species of sea lice occur on Atlantic salmon in BC - *Lepeophtheirus salmonis* (the 'salmon louse') and to a lesser extent *Caligus clemensi* (the 'herring louse'). Both species are naturally occurring parasites that attach to skin, fins and gills of fish and feed on the mucus and skin. Their distribution varies seasonally, annually and regionally on both farmed and wild salmon. The intensity of infections also varies by species, location and years. Water temperature, salinity and water movement are the major factors influencing the prevalence of sea lice as is the number of returning wild fish in the area. Other types of marine fish (herring, stickleback, rockfish, greenling, ratfish and Pollock) are also known to host sea lice and may serve as reservoirs

The number of sea lice on farmed Atlantic salmon is influenced by many factors including the age of the salmon and the time in seawater; location and season; salinity and numerous other environmental factors affecting both the sea lice and the host; proximity to sources of sea lice; and application of sea lice treatments.

In addition to these factors, there is a wide range of susceptibility among the different species of Pacific salmon that also varies with size of the fish. Atlantic salmon have greater susceptibility and are less likely to shed sea lice compared to Pacific salmon. See Appendix A for more information on sea lice management in BC and Appendix B for information on sea lice life history, abundance and distribution, and host susceptibility.

Sea Lice and Aquaculture

BC farmed salmon begin their lives in freshwater hatcheries and are transferred to ocean net pens lice free. Once in the ocean, farmed salmon are exposed to sea lice from a variety of sources, particularly in the fall as adult wild salmon carrying sea lice return to the coast from the open ocean. The focus of an IPM strategy is to manage sea lice levels: 1) in compliance with Pacific Aquaculture Regulations conditions of licence aimed at mitigating impacts to wild fish, and 2) to enable salmon farmers to manage pests for the best interests of animal care and productivity. DFO has established and uses the three motile sea lice threshold as a precautionary measure for conservation of wild salmon.

To date, the impact of sea lice on Atlantic salmon farming operations in BC is less than on farming operations in other jurisdictions. Farmed Pacific salmon are also susceptible to sea lice but generally at lower levels. Concerns regarding the potential for sea lice from farmed salmon to impact the health of wild migratory salmon stocks led to the establishment of precautionary management thresholds. Licence holders must take action to reduce the absolute lice inventory at a farm if the sea lice abundance exceeds the threshold during the wild salmon out migration period (March 1-June 30). During the rest of the year, licence holders cultivating Atlantic salmon must provide DFO with a plan that describes how a reported threshold exceedance will be addressed.

Core Elements of an IPM for Aquaculture

The management of pests on farmed animals has evolved into comprehensive Integrated Pest Management (IPM) programs that minimize the effects of the pest through a combination of preventative and curative strategies. For salmon farming, IPM also needs to take into account the broad changes to the marine environment associated with global warming, the varied micro-

Integrated Pest Management Approach to Sea Lice Management for BC Atlantic Salmon Aquaculture Facilities

environments where salmon farms are located, the different times of year for treatments, and the different salmon sizes and life stages being treated.

The four core elements of IPM include prevention, monitoring, thresholds for management action, and a suite of readily available and effective management tools. For a more detailed description of the core elements, see Appendix C.

Prevention

Sea lice are naturally occurring and are present in the farming areas and on the wild fish in the areas. Prevention measures undertaken to manage the numbers of sea lice on farmed salmon include:

- Appropriate siting of salmon farms to manage sources and transmission of sea lice to farmed fish, to maintain water quality for stock husbandry, and to operate the site efficiently.
- Good husbandry practices to maintain the health of farmed fish include management activities; such as year class separation, fallowing, biofouling (organisms and shellfish attaching to infrastructure) removal, plankton bloom mitigation, nutrition management, predator control, and hygiene protocols.
- Strategic use of management tools such as site fallowing, area based management, and harvesting.
- Outside of BC, sea lice resistant fish stocks produced through selective breeding programs are used.

Monitoring

- Routine monitoring of sea lice numbers by fish health professionals and trained farm staff provide a site-specific picture of sea lice populations which enables proactive/optimal use of management tools throughout the production cycle.
- In the future, new sea lice treatments may also require corresponding changes to the monitoring approach.

Thresholds for Management Action

- Thresholds, established by DFO, identify when management actions are to be initiated.
- Thresholds must take into consideration environmental risks, potential for development of resistance with therapeutants, and the potential success of reducing the number of sea lice.

Suite of Management Tools

- Once a threshold has been met, sea lice management is initiated.
- Each situation is unique and requires a specific and unique management response and depending on the situation may require the use of more than one management tool.
- A clear decision framework ensures the appropriate tools are being used, taking into consideration environmental effects, efficacy of the tool, and regulations on the use of each tool.

Integrated Pest Management Approach to Sea Lice Management for BC Atlantic Salmon Aquaculture Facilities

Chemical Controls - Therapeutants include a variety of compounds used to treat sea lice on farmed salmon – topically and orally. See Table 3 for a list of therapeutants available globally and those currently in use in BC. These treatments have generally been adapted from drugs or pesticides used in terrestrial agricultural operations. Veterinary drugs and pest control products are regulated in Canada by Health Canada's Veterinary Drugs Directorate and Pest Management Regulatory agency respectively. In British Columbia, the use of pest control products also requires authorization from the provincial Ministry of Environment (typically a Pesticide Use Permit). Also, included in this group are vaccines and immunostimulants which are currently under research and development. Vaccines target developing an immunity to sea lice while immunostimulants target activating the immune system of fish to reduce incidence rates. In Canada, vaccines for animals are regulated by the Canadian Food Inspection Agency.

Physical Controls - Physical controls, such as structural barriers and/or physical mechanisms to block or remove sea lice from fish, are another key element of an IPM strategy. Control measures include lice skirts/filter tarps and mechanical removal. Other approaches are being developed and may be commercially available in the next five years. See Table 4 for a list of physical controls and strategies available for use globally and in BC.

Biological Controls - Biological controls include the use of other fish species that consume or 'clean' sea lice from farmed salmon. In Europe, cleaner fish have been proven effective in removing and controlling sea lice.

Moving an IPM Approach Forward

DFO and the BC salmon farmers recognize the importance of a comprehensive sea lice management approach and support the implementation of an IPM strategy. The following outlines activities that are required to implement this approach fully.

1. Expansion of Commercially Available Therapeutant Measures

In BC, two federally registered therapeutants are available: emamectin benzoate (SLICE®) which is available for use, and the topical product hydrogen peroxide (Interlox Paramove 50®). The latter requires additional Pesticide Use Permits issued from the BC Ministry of Environment for each production site/grouping, on a three-year basis. To date, very few sites have Pesticide Use Permits for hydrogen peroxide. It should be noted that therapeutants can only be used under specific fish husbandry and environmental conditions. For example, bath treatments such as hydrogen peroxide cannot be undertaken during periods of high water temperatures, low dissolved oxygen and/or plankton blooms.

Administrative challenges in registering and permitting pest control products has severely limited access to management tools available in other jurisdictions and hampers the development of a sea lice IPM for BC.

Integrated Pest Management Approach to Sea Lice Management for BC Atlantic Salmon Aquaculture Facilities

The table below lists options available globally for sea lice management.

Table 2 Sea lice Treatments Used Globally and Treatments Currently Used in BC			
Product	Application Method	Status of Treatments: R&D or In Use	
		British Columbia	Other Countries
Aqui-S (active ingredient eugenol)	Bath	NOT CURRENTLY AVAILABLE	In Use: New Zealand, Australia, USA, Chile, Norway
Ektobann/Calicide (active ingredient teflubenzuron)	In-feed	NO LONGER AVAILABLE	In Use: Ireland (partial), Norway, Eastern Canada, Faroe Islands
Excis/Betamax (active ingredient cypermethrin)	Bath	NOT CURRENTLY AVAILABLE	In Use: Chile, Ireland (partial), Scotland, Norway, Tasmania, USA, Tasmania, Eastern Canada, Faroe Islands
Alphamax (active ingredient deltamethrin)	Bath	NOT CURRENTLY AVAILABLE	In Use: Chile, Ireland (partial), Scotland, Norway, Tasmania, USA, Faroe Islands
Releeze (active ingredient diflubenzuron)	In feed	NOT CURRENTLY AVAILABLE	In Use: Chile, Norway, Tasmania, Faroe Islands
IMVIXA (lufenuron)	In feed for freshwater	NOT CURRENTLY AVAILABLE	In Use: Chile
Salmonsan (active ingredient azamethiphos)	Bath	NOT CURRENTLY AVAILABLE	In Use: Eastern Canada, Chile, Ireland (partial), Scotland, Norway, Tasmania, Faroe Islands
SLICE® (active ingredient emamectin benzoate)	In feed	IN USE	In Use: Canada, Chile, Ireland, Scotland, Norway, Tasmania, USA, Faroe Islands
Interlox Paramove 50 (active ingredient hydrogen peroxide)	Bath	IN USE AT PERMITTED SITES	In Use: Canada, Chile (partial), Ireland, Scotland, Norway, Tasmania, USA, Faroe Islands

2. Research and Development of IPM Alternative Approaches and Strategies

IPM strategy is a commitment to continual improvement through the development and adoption of new technologies and state-of-the-art management processes for BC.

Integrated Pest Management Approach to Sea Lice Management for BC Atlantic Salmon Aquaculture Facilities

Research conducted in other areas has supported development of innovative methods to manage sea lice. The table below shows the variety of tools now available globally and the status of these tools in BC.

Table 3 IPM Alternative Approaches and Strategies Under Development Globally and Status in BC			
Tool	Application Method	Status of Tools: Requires R&D or In Use	
		British Columbia	Other Countries
Lice skirts	On site	R&D	In Use: Ireland, Scotland, Norway, Faroe Islands, Chile
Hydrolicer	Barge	R&D	In Use: Ireland, Scotland, Norway, Faroe Islands
Deep lights/deep feeding	On site	R&D	In Use: Scotland, Norway
Thermolicer/Optilicer	Barge/Boat	R&D	In Use: Scotland, Norway, Chile
Laser	Onsite	R&D	In Use: Scotland, Norway
Snorkel sea cages	On site	R&D	In Use: Norway
Fresh water	Well boat/On site	R&D	In Use: Norway, Ireland, Scotland
Immunostimulants	In feed	R&D	In Use Ireland, Scotland, Norway, Faroe Islands, Chile
Vaccines	Injected	R&D	R&D
Cleaner Fish	Co-culture	R&D	In Use: Ireland, Scotland, Faroe Islands, Norway, east coast of Canada
Resistant broodstock selection	Genetic mapping	R&D	In Use: Norway
Facility siting	On site	In Use	In Use: All
Dispersal models	Area Based Management	In Use for some sites	Under development in most jurisdictions

Integrated Pest Management Approach to Sea Lice Management for BC Atlantic Salmon Aquaculture Facilities

Long term successful research and development requires collaboration between the salmon farmers and federal and provincial governments to address all elements of moving an IPM forward.

- Industry led and funded research & development programs, such as the Marine Environmental Research Program.
- Financial support (government) to support preventative and curative management.
- Research facilities to undertake R&D.
- Regulatory support to pilot solutions in BC.

3. Pilot Testing of Innovative Measures

Solutions identified through research and development activities need to be further tested in a production setting to evaluate potential usefulness and to fine tune the technology or process to improve effectiveness. This requires government and industry support for pilot projects from both regulatory and financial perspectives. Funding programs targeting innovation and pre-commercialization pilot projects (e.g. DFO's Aquaculture Innovation and Market Access Program) are needed to transform valuable R&D concepts into commercially useful solutions.

4. Commercialization of New Tools

Financial support is essential to bridge the gap between R&D innovation and the commercialization of new tools. This support could be used to reduce development barriers such as scalability and marketing. As tools become commercialized, market pull has the potential to drive further innovation in BC. It also generates a healthy business environment with increased access to capital investment. This important feedback loop would ensure that BC salmon farmers are positioned at the forefront of ongoing development to ensure a long term successful IPM.

5. Fallowing, Year Class Separation, and Other Measures

Advancing the core element of prevention in an IPM for farmed salmon requires collaboration between the industry, federal and provincial governments for the following:

- Access to sites to enable fallowing and year class separation
- Greater flexibility around movement of existing farms and changes in production plans
- Deployment of alternate cage systems that increase water flow
- Research into impacts of global warming on both wild and farmed salmon including effect on phytoplankton
- Development and deployment of alternate plankton mitigation measures
- Commercial access to functional diets as they become available
- Research into improved predator deterrent systems
- Continued research into fish health improvements
- Continued research into native cleaner fish – identification of suitable species, research into rearing, husbandry, management and broodstock.

Integrated Pest Management Approach to Sea Lice Management for BC Atlantic Salmon Aquaculture Facilities

6. Area Based Management

A sustainable IPM approach would include the principles of area based management using adaptive and risk-based responses to sea lice as a function of the presented risk to surrounding ecosystems. Effective area based management will incorporate environmental factors (e.g. temperature, salinity and dispersion) and company management objectives (e.g. number and location of farms, year class, number of fish stocked and distance between farms).

- Long term and coast wide real-time data to make effective management plans
- Wild fish data including migratory patterns and potential for interaction with farm fish; population dynamics including escapement, migrations, abundance; juvenile fish lice loads; other hosts
- Research and information on wild stock influences and environmental influences
- Local and coast wide environmental monitoring data including temperature, salinity, currents to make effective management decisions
- Research into hydrographic models to define new sites and zones for area based management
- Integrated pest management plans where salmon farms are in close proximity

Area based management goals are dependent on licence holders having access to multiple facilities to enable continuous production (e.g. year class separation) and further discussions on co-ordinating between different operators through groups such as the BCSFA are necessary.

Summary

DFO and the BC salmon farmers recognize the role of IPM to manage sea lice. An IPM strategy will help DFO meet management objectives for wild as well as farmed fish. IPM will also enable salmon farmers to manage pests for the best interest of animal welfare and productivity.

A successful IPM approach requires existing and new management tools for the BC salmon farmers. These include chemical, biological and physical strategies. In the future, new sea lice treatments may require corresponding changes to sea lice management and monitoring approaches.

Moving forward and developing a successful IPM for sea lice will require the following.

1. Additional treatments and methods made available for the salmon farmers in BC including tools used in other parts of the world.
2. Federal, provincial and salmon farmers-supported research programs that target innovative approaches to sea lice management.
3. Financial and regulatory support for the testing and implementation and commercialization of new and innovative tools.
4. Enabling policies and legislations to facilitate the use of new tools.

Appendix A Sea Lice Management for Atlantic Salmon Farms in BC

In British Columbia, DFO issues licenses for marine finfish aquaculture that include monitoring and intervention requirements at threshold limits for the number of sea lice on fish. For Atlantic salmon farms, licence holders must take action to reduce the absolute lice inventory at salmon farms if the sea lice abundance exceeds the threshold during the wild salmon out migration period. During the rest of the year, licence holders must provide DFO with a plan that describes how a reported threshold exceedance will be addressed.

Prior to 2002, sea lice infestations at BC salmon farms were not considered a significant concern. Treatments for sea lice infestations were rare and there was limited data recorded. In 2002, an unexpectedly low return of Pink salmon and growing concern about sea lice found on wild Atlantic salmon in Europe, led to reports in scientific journals and the print media suggesting that in BC sea lice from Atlantic salmon farms were negatively impacting juvenile wild Pink salmon, and in turn, affecting wild salmon returns.

In 2003, the provincial government, who was the regulator, initiated the Sea Lice Management Strategy that included sea lice monitoring systems and control measures on BC salmon farms. The strategy stipulated that during the period of juvenile Pink salmon migration out of the nearshore, from March through to the end of June, sea lice species *Lepeophtheirus salmonis* were to be maintained below three motile (i.e. having the power to move spontaneously) lice per fish. If levels exceeded this threshold during this three-month period, the fish were to be treated or harvested. Management options during the remainder of the year were at the discretion of the license holder.

The sea lice threshold was selected by government and salmon farmers as a level that would allow precautionary management while scientific data was gathered to better determine the relationship between sea lice on wild and farmed fish.

It was also acknowledged that there was a lack of serious effects of sea lice on BC farmed salmon compared to other global jurisdictions due to genetic difference in the sea lice species. Further, that the large populations of wild salmon in BC are known to carry sea lice and contribute to sea lice abundance on farmed salmon particularly during the summer and fall migration period.

In 2010, DFO assumed regulatory responsibility for aquaculture activities in British Columbia. Threshold levels, monitoring and audit programs remained similar to those used by the provincial government with the exception that licence holders were required to report sea lice levels directly to DFO.

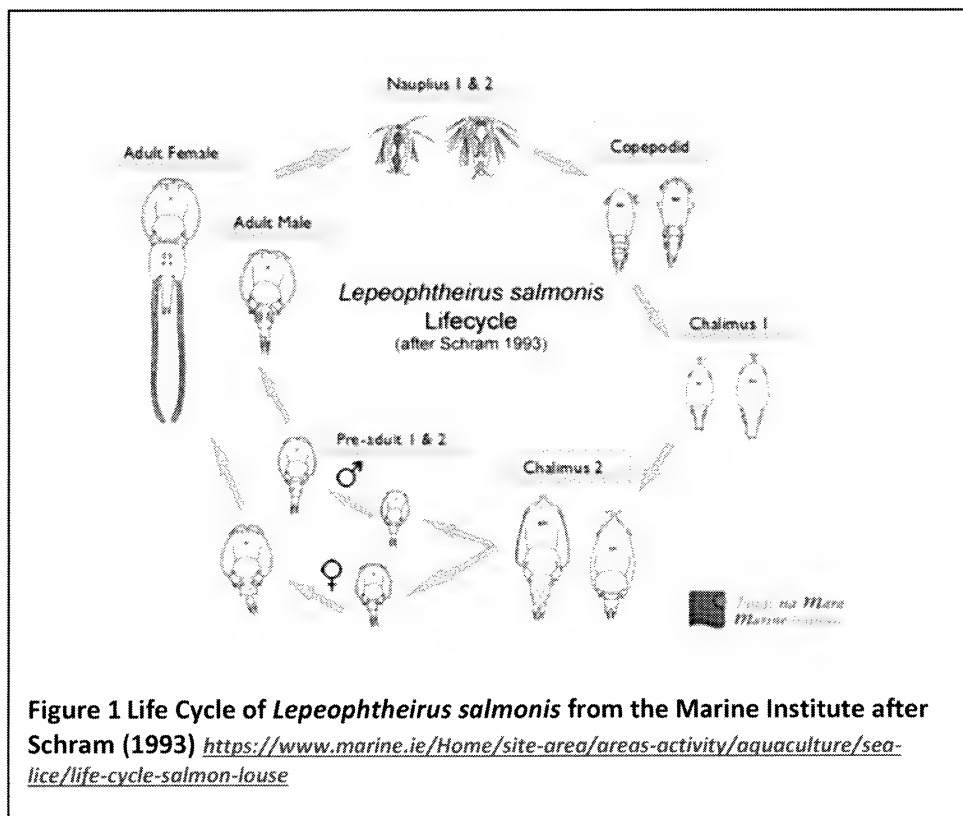
In the 2016 BCSFA Sustainability Progress Report, the BC salmon farmers re-iterated the commitment to sea lice management through an IPM strategy to meet the required standards of both governmental regulators and third-party certification bodies, such as the Global Aquaculture Alliance's Best Aquaculture Practises certification and Aquaculture Stewardship Council's certification.

Appendix B Sea Lice Biology

Life Cycle and Distribution

Sea lice are naturally occurring parasites that reside on the bodies of both wild and farmed fish. They attach themselves to the skin, fins, and gills of fish and feed on mucus and skin. The term “sea lice” refers to several life stages and species of parasitic copepods. For salmon farm sea lice management in British Columbia, there are two main species of interest – *Lepeophtheirus salmonis* and *Caligus clemensi*.

Sea lice life history is broadly divided into free-living and parasitic phases. The copepodid stage is the most common stage that infects salmon although some transfer of pre-adult and adult stages does occur between fish. Water temperature, salinity and water movement (from tides and currents) are the major physical and environmental factors influencing sea lice dynamics. Temperature and salinity influence sea lice development, growth, survival and reproduction rate. Currents and water column mixing processes influence the transport and dispersal of the free-living stages of sea lice (nauplius and copepodid stages).



Integrated Pest Management Approach to Sea Lice Management for BC Atlantic Salmon Aquaculture Facilities

Sea lice distribution and prevalence varies seasonally, annually and regionally on both farmed and wild fish. The influence of wild fish as sea lice hosts is well documented. In the Broughton Archipelago, the number of returning Pink salmon is a key factor to predict the number of sea lice on farmed salmon for the following spring.

Hosts and Host Susceptibility

Host susceptibility, the host being a wild fish or farmed fish, varies between fish species. Host response, damage to the host, and the quantity of wild hosts in the ecosystem all affect the number of sea lice on farmed salmon.

There is a wide range of susceptibilities to infestation with *L. salmonis* sea lice on Pacific salmon. The abundance of sea lice on Pacific salmon is influenced by many factors, including:

- species of salmon;
- the age of the salmon;
- its length of time in seawater;
- by sea lice location and season;
- the proximity of the host fish to sources of sea lice;
- the application of sea lice treatments on farmed fish; and
- by numerous other environmental factors affecting both the sea lice and the wild fish or farmed fish host.

Farmed Atlantic salmon are transferred from freshwater hatcheries to ocean net pens free of sea lice. In the ocean, farmed salmon are exposed to sea lice from a variety of sources, particularly wild salmon returning to their spawning grounds. Atlantic salmon are more susceptible to sea lice infestation than the various species of Pacific salmon. Atlantic salmon would be the most likely salmonid to have *L. salmonis* sea lice and the least likely to shed them naturally. Despite this susceptibility, no harm to Atlantic salmon stocks at farm sites has been observed in BC.

Non-salmonid species also host sea lice and are potential reservoirs for the transfer of sea lice to both wild and farmed salmon. Many species of marine fish (herring, stickleback, rockfish, greenling, ratfish, sand lance, lingcod and Pollock) are known to host *Caligus species*. Similarly, *L. salmonis* occur on Pacific sand lance, lingcod, three-spine stickleback and white sturgeon. The duration and intensity of sea lice vary by species, location and among year classes of the host fish.

Appendix C Detailed Elements of an IPM Strategy for Sea Lice

Prevention - Facility Siting

At least initially, sea lice infestations are predominantly derived from wild hosts in the area and from sea lice drifting into the area on prevailing currents. Siting farms away from locations where wild salmon are known to concentrate (e.g. salmon bearing rivers/streams and estuarine holding areas), can be useful in reducing the number of sea lice on farmed fish.

Characteristics such as water depth, tidal range, currents and sea bottom types are considered by both salmon farmers and regulators in siting assessments as they influence the environmental sustainability of the farm. In particular, good water flow can prevent build-up of sea lice larvae at a site and can contribute to the dispersion of therapeutants following a treatment.

The distance between farms is a provincial and federal requirement. Spacing between farms can reduce the transmission of sea lice between farms. Facilities operating on a common or shared production cycle within a defined area can also co-ordinate treatments on an area-based level.

Prevention - Husbandry

Good husbandry practices are an important and key aspect of sea lice management and prevention. Maintaining the health of farmed fish and mitigating potential risks from interactions between farmed and wild stocks are integral components of the salmon farmer's mandatory Health Management Program (HMP). This is achieved through a number of management activities as described below.

Year Class Separation

Year class separation is considered one of the most effective IPM-related husbandry techniques, with production sites stocked as a single year class and an all-in/all-out harvest policy. Juveniles are not introduced into facilities where older fish are already at the farm. This reduces juvenile salmon exposure to sea lice from older fish. Where year class separation is not feasible, treating salmon already on the farm will reduce lice numbers before introducing new fish.

Biofouling Removal

Routine in-situ net cleaning ensures the water flow through the site is optimized, reducing stress and improving the general health of farmed salmon.

Plankton Blooms Management

Plankton management indirectly mitigates the risks associated with sea lice by reducing stress on the salmon and improving fish health. Activities may include a HAMP (Harmful Algal Monitoring Program) and plankton mitigation measures such as deployment of bubble walls, tarpaulin skirts and aeration.

Nutrition Management

Maintaining fish health increases the efficacy of sea lice treatments and the opportunities for applying other types of sea lice management. This includes the use of high quality feed and feeding management integrated with fish health support.

Integrated Pest Management Approach to Sea Lice Management for BC Atlantic Salmon Aquaculture Facilities

Predator Control Management

Predators are stressful for farmed fish with related risks to fish health. Predator control measures (e.g. deployment of bird nets, shark guards, full predator nets) reduces the potential stress.

Hygiene Protocols

Farm operational hygiene within the operator's comprehensive Fish Health Management Plan is required for all licenced facilities. This includes daily removal of mortalities, regular cleaning of equipment, limiting visitors, and restricting extensive movements of equipment.

Prevention – Resistant Broodstock Selection

Internationally, commercial fish breeding programs are developing 'sea lice resistant' stocks. Currently, there are no commercial breeding companies working in BC. Individual farming companies do have breeding programs, but selection for sea lice resistance has not occurred.

The scale of the BC salmon farming has been a limitation to attracting innovation and investment. Currently there are only a few small local facilities to support sea lice challenges and genetic testing in BC. Support for larger institutes and existing facilities, such as the BC Centre for Aquatic Health Sciences, to provide these services, is key to developing the suite of tools necessary for an Integrated Pest Management system.

Monitoring and Identification

Decisions on when to conduct a sea lice treatment at a farm are based on the results from a program of routine monitoring of sea lice numbers, managed by the operator's fish health professionals. Monitoring is conducted continuously following the transfer of juveniles from hatchery through to harvest. Fish health staff evaluate sea lice populations and develop assessments and optimal management practises. IPM-linked activities include routine monitoring, training staff on sea lice identification, and reporting sea lice abundance at the facility.

Thresholds for Action

Thresholds of the number of sea lice that trigger treatment, are determined by accounting for potential risks of the sea lice becoming resistant to treatment, the operator's obligation to safeguard the farmed salmon, and ability to reduce the real or perceived risks associated with the transfer of sea lice from farmed fish to wild fish.

A threshold that is too low can lead to unnecessary treatments which can accelerate the development of sea lice resistance.

Current regulatory thresholds in BC set out in DFO's conditions of licence are as follows:

- Calendar year March 1 to June 30: if the sea lice count exceeds 3 motile lice (*Lepeophtheirus salmonis*) per fish the operator will implement a plan to reduce absolute sea lice inventory within 15 days.

Integrated Pest Management Approach to Sea Lice Management for BC Atlantic Salmon Aquaculture Facilities

- July 1 to February 28: if the sea lice count exceeds 3 motile lice (*Lepeophtheirus salmonis*) per fish then the operator will provide a plan to DFO to address this within 30 days.

Control Measures

Biological

The use of cleaner fish, such as wrasse or lumpstickers, to remove sea lice from salmon has shown promising results in Norway and Scotland. BC's salmon farmers are currently supporting research under the Marine Environmental Research Program (MERP) to identify potential local species that may act as cleaner fish to remove sea lice from farmed salmon in BC. A BC Salmon Farmers Association group is also working with DFO to determine the regulations and protocols required around various options for the use of biological measures.

Therapeutants

In BC, there are two fully registered therapeutants available.

SLICE® became available for veterinarians to administer under special permit, Emergency Drug Release or EDR, obtained from Health Canada in 1999 and gained full registration approval in 2000. Until 2013, SLICE® was the only therapeutant used for sea lice in British Columbia.

BC's salmon farmers are concerned about the inherent limitation of having only one sea lice treatment product available. This situation differs from other agricultural practices which utilize a rotation of treatments as part of an integrated pest management program to increase effectiveness and prevent or delay development of resistance to treatments.

Interlox Paramove 50® became available for use under an Emergency Use Registration label in October 2013 and received full registration in March 2015. However, applications are limited as environmental conditions can prevent the use of Paramove 50®. During plankton blooms and during certain periods, SLICE® is the sole therapeutic treatment option. BC's Ministry of Environment requires application for a Pesticide Use Permit prior permission for the use of Interlox Paramove 50® at salmon farms.

Vaccines and Immunostimulants

Vaccines and immunostimulants, or functional feeds, are potential tools for sea lice control. These products are currently under development.

Others

Non-therapeutic control measures such as tarps, lice skirts, mechanical removal and freshwater bathing are being investigated by BC operators. Methodologies are still being refined as physical controls can be stressful for the farmed salmon and removal efficacy varied. Further research is required to determine how these methods will be used in BC.

Examples of new types of treatments are:

- Thermolicer, (<http://www.steinsvik.no/en/products/e/seaculture/fish-health/thermolicer>);

Integrated Pest Management Approach to Sea Lice Management for BC Atlantic Salmon Aquaculture Facilities

- Hydrolicer (<http://www.fishfarmingexpert.com/news/hydrolicer-unveiled/>)

Freshwater treatments have also been trialed but require significant infrastructure as the treatments are seven hours in duration.

Other approaches are still under development and may be commercially available in the next five years, including the Snorkel lice barrier system and Stingray delousing.

(['Snorkel' sea lice barrier technology reduces sea lice loads on harvest-sized Atlantic salmon with minimal welfare impacts](https://www.researchgate.net/publication/294579093)),
(<http://en.stingray.no/>)

Appendix D Bibliography

The following list of references and materials were used during the development of this document.

Health Canada – Integrated Pest Management of Sea Lice in Salmon Aquaculture
(<http://publications.gc.ca/collections/Collection/H114-9-2003E.pdf>)

Lepeophtheirus salmonis: a persisting challenge for salmon aquaculture (doi:10.2527/af.2014-0004)

A SUMMARY OF SEA LICE IN BC – WILD AND FARMED MONITORING AND MANAGEMENT Saksida 2015

Detection of emamectin benzoate tolerance emergence in different life stages of sea lice,
Lepeophtheirus salmonis, on farmed Atlantic salmon, *Salmo salar* L. P G Jones et al 2013 doi:10.1111/jfd.12022

Integrated Pest Management of Sea Lice in Salmon Aquaculture – Myron Roth presentation Speaking for
the Salmon - <https://www.sfu.ca/cstudies/science/resources/1273698226.pdf>

Delaney, Paula

From: Rainer, Michelle
Sent: May-04-18 3:26 PM
To: Doucette, Claire; Webb, Allison
Subject: URGENT: sea lice media lines for approval

Importance: High

Hi Allison,

Can you please review ASAP? Claire, I just want to make sure it's OK to use the word "investigating" in this case; I know there are specific instances in which we're supposed to use it.

Thanks,
Michelle

Issue: [REDACTED] CBC Victoria ([REDACTED]),
Parksville Qualicum Beach News, ([REDACTED]). Looking for response on high levels of sea lice reported at Cermaq Canada farms in BC's Clayoquot area. See press release issued May 5 by Clayoquot Action Campaigns, provided below.

Deadline: Friday, May 5, 4:00 p.m. PST

Recommendation: email approved response

Approved by: Zac Waddington

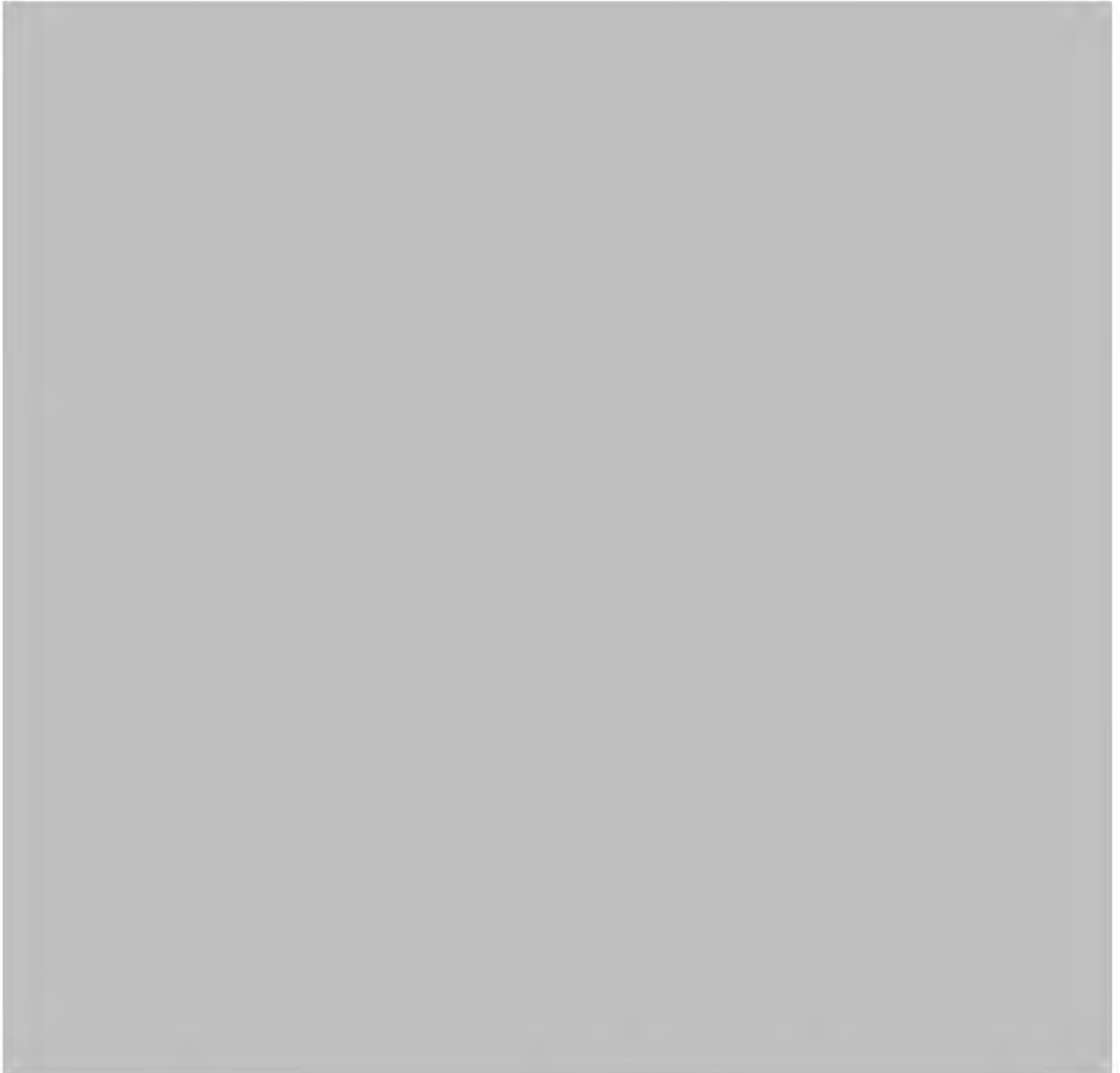
Media lines:

- DFO is aware of the sea lice exceedances at Cermaq Canada's facilities in Clayoquot and has been in ongoing discussions with the company since January 2018 about measures to reduce sea lice levels.
- Under the Pacific Aquaculture Regulations, DFO requires salmon farming companies to regularly monitor and manage sea lice levels at their facilities in BC. DFO also regularly conducts assessments of sea lice abundance at these facilities.
- Companies in BC must submit a lice reduction plan if monitoring shows sea lice levels higher than three motile sea lice per farmed fish during the wild salmon outmigration period from March 1 to June 30 of each year. Motile lice are those at the free-moving stages of their life cycle.
- Salmon farming companies use an in-feed therapeutant called SLICE (emamectin benzoate) to reduce lice abundance. In cases where the use of SLICE does not result in adequate reduction of sea lice, companies can apply to the province of British Columbia for a permit to use alternative treatments, including Paramove (a hydrogen peroxide bath).
- Cermaq has applied for a permit but has not yet obtained one from the province of BC. Please contact Cermaq or the Province of BC's Ministry of Agriculture for further information on this process.
- Hydrogen peroxide is widely used around the world, including elsewhere on Canada's west coast, with excellent effect and no demonstrable effects to the ecosystem. This pesticide is not absorbed by the fish and is non-toxic to humans. It also dissipates as a neutralized substance quickly in the environment and causes no discernible far-field effect.

- DFO is investigating the management of lice at farms in Clayoquot by Cermaq Canada to determine if there has been non-compliance with the licence conditions and cannot comment further at this time.
- DFO makes reports on the numbers of sea lice at BC aquaculture farms available to the public at www.dfo-mpo.gc.ca/aquaculture/protect-protege/parasites-eng.html.

FOR IMMEDIATE RELEASE:

Salmon lice outbreak could devastate Clayoquot salmon



s.68(a)

-30-

Clayoquot Action

High res photos of Clayoquot May 2018 juvenile salmon with lice and Cermaq salmon lice graphs available here:

<https://drive.google.com/drive/folders/1ps-GumjM4j7RmsYT-kVu1GjJR2ojltqz?usp=sharing>

Cermaq's public reporting webpage: <https://www.cermaq.com/wps/wcm/connect/cermaq-ca/cermaq-canada/our-promise/public-reporting/>

s.19(1)

s.68(a)

Waddington, Zac

From: Waddington, Zac
Sent: May-04-18 3:31 PM
To: Sandberg, Krista
Subject: RE: Media request on sea lice

Very exciting!

Zac

From: Sandberg, Krista
Sent: May-04-18 3:16 PM
To: Waddington, Zac
Subject: RE: Media request on sea lice

Just as an aside, AAR now requires start and end dates for drug deposits. I'm working on compiling the templates and planned on sending them to industry to fill in the dates as our current template doesn't have date fields. However, the new template which is almost done, will match the national template so we will soon get the dates we need in a timely manner. Stay tuned.

Krista Sandberg

Office | Bureau 250-286-5835
Cellular | Cellulaire [REDACTED]



Government
of Canada

Gouvernement
du Canada

Canada

From: Waddington, Zac
Sent: Friday, May 04, 2018 2:31 PM
To: Rainer, Michelle
Cc: Sandberg, Krista; Keith, Ian
Subject: RE: Media request on sea lice

s.16(2)(c)

s.21(1)(a)

s.21(1)(b)

Very interesting timing. We are indeed aware of this and I just finished chatting with Ian about the lice management in Clayoquot and first thing next week we are meeting to discuss [REDACTED] The waters are muddied a bit since they submitted a series of plans for sites over threshold back in Jan and Feb which involved the use of Paramove (peroxide). However, the use of Paramove requires a Pesticide Use Permit, issued by the province. This was expected to be in place before the outmigration period, but is still pending. So Cermaq moved to harvesting as a management action, which is acceptable; [REDACTED]

So the short answer is that they are over, we don't yet know if they can be held at fault for this. They also had some sub-par SLICE treatments which has further exacerbated the lice problem.

I'm not sure what more we can/should say about it at this time. Perhaps the best thing to say is:

"DFO regulators are aware of the lice exceedances in Clayoquot and have been in ongoing discussions with Cermaq since the beginning of 2018. Cermaq has faced challenges with attaining a Pesticide Use Permit for Paramove (hydrogen peroxide bath), which is within provincial jurisdiction. DFO strongly encourages an Integrated Pest Management approach to sea lice management, and a key component of that is the availability and rotational use of numerous lice

control techniques. The public opposition to the use of hydrogen peroxide is ill-founded and directly impacting the effective management of lice by salmon farmers [I understand if you don't want to include this last sentence-but it's true].

We cannot comment further at this time since the management of lice at farms in Clayoquot by Cermaq is currently being investigated to determine if there has been non-compliance with the licence conditions. "

This should definitely be reviewed by Adrienne and Allison before going out.

Zac

From: Rainer, Michelle
Sent: May-04-18 1:37 PM
To: Waddington, Zac
Cc: Sandberg, Krista
Subject: Media request on sea lice

Hi Zac,
Can you help with this request today? Or Krista? Sorry, busy day!
Thanks,
Michelle

From: [REDACTED]
Sent: May-04-18 12:19 PM
To: RHQ - Media.PAC
Subject: CBC News request

Hello,

The current reporting for sea lice at Cermac Canada salmon farms in Clayoquot Sound shows levels well over the threshold for treatment at about half of the 14 farms. I'm seeking comment on whether this is a concern and whether it could impact wild salmon in the area.

Thanks,

[REDACTED]
CBC Victoria

Phone: [REDACTED]

Cell: [REDACTED]

s.19(1)

Waddington, Zac

From: Waddington, Zac
Sent: May-04-18 3:38 PM
To: Paylor, Adrienne
Subject: FW: Media request on sea lice

From: Rainer, Michelle
Sent: May-04-18 3:20 PM
To: Waddington, Zac
Subject: RE: Media request on sea lice

Perfect, thanks Zac. I also made this change:

The province has granted Cermaq Canada a permit for the use of Paramove. Please contact Cermaq or the BC Ministry of Agriculture for further information on this process.

From: Waddington, Zac
Sent: May-04-18 3:11 PM
To: Rainer, Michelle
Subject: RE: Media request on sea lice

Thanks very much for drafting those. I made one small but important change, since peroxide is being used elsewhere in BC already.

- DFO is aware of the sea lice exceedances at Cermaq Canada's facilities in Clayoquot and has been in ongoing discussions with the company since January 2018 about measures to reduce sea lice levels.
- Under the *Pacific Aquaculture Regulations*, DFO requires salmon farming companies to regularly monitor and manage sea lice levels at their facilities in BC. DFO also regularly conducts assessments of sea lice abundance at these facilities.
- Companies in BC must submit a lice reduction plan if monitoring shows sea lice levels higher than three motile sea lice per farmed fish during the wild salmon outmigration period from March 1 to June 30 of each year. Motile lice are those at the free-moving stages of their life cycle.
- Salmon farming companies use an in-feed therapeutant called SLICE (emamectin benzoate) to reduce lice abundance. In cases where the use of SLICE does not result in adequate reduction of sea lice, companies can apply to the province of British Columbia for a permit to use alternative treatments, including Paramove (a hydrogen peroxide bath).
- Cermaq has applied for a permit but has not yet obtained one from the province of BC. Please contact Cermaq or the Province of BC's Ministry of Agriculture for further information on this process.
- Hydrogen peroxide is used widely world-wide, including elsewhere on Canada's west coast, with excellent effect and no demonstrable effects to the ecosystem. This pesticide is not absorbed by the fish and is non-toxic to humans. It also dissipates as a neutralized substance quickly in the environment, causing no discernible far-field effect
- DFO is investigating the management of lice at farms in Clayoquot by Cermaq Canada to determine if there has been non-compliance with the licence conditions and cannot comment further at this time.
- DFO makes reports on the numbers of sea lice at BC aquaculture farms available to the public at www.dfo-mpo.gc.ca/aquaculture/protect-protege/parasites-eng.html.

Zac

From: Rainer, Michelle
Sent: May-04-18 2:51 PM
To: Waddington, Zac
Subject: RE: Media request on sea lice

Thanks, Zac. There is a press release (forwarded separately) and 2 media requests so far. I have added to your input using some lines from a previous exceedance event. How about:

- DFO is aware of the sea lice exceedances at Cermaq Canada's facilities in Clayoquot and has been in ongoing discussions with the company since January 2018 about measures to reduce sea lice levels.
- Under the *Pacific Aquaculture Regulations*, DFO requires salmon farming companies to regularly monitor and manage sea lice levels at their facilities in BC. DFO also regularly conducts assessments of sea lice abundance at these facilities.
- Companies in BC must submit a lice reduction plan if monitoring shows sea lice levels higher than three motile sea lice per farmed fish during the wild salmon outmigration period from March 1 to June 30 of each year. Motile lice are those at the free-moving stages of their life cycle.
- Salmon farming companies use an in-feed therapeutant called SLICE (emamectin benzoate) to reduce lice abundance. In cases where the use of SLICE does not result in adequate reduction of sea lice, companies can apply to the province of British Columbia for a permit to use alternative treatments, including Paramove (a hydrogen peroxide bath).
- Cermaq has applied for a permit but has not yet obtained one from the province of BC. Please contact Cermaq or the Province of BC's Ministry of Agriculture for further information on this process.
- Hydrogen peroxide is used on Canada's east coast and elsewhere in the world to remove sea lice from cultured fish. This pesticide is not absorbed by the fish and is non-toxic to humans. It also dissipates as a neutralized substance quickly in the environment, causing no discernible far-field effect
- DFO is investigating the management of lice at farms in Clayoquot by Cermaq Canada to determine if there has been non-compliance with the licence conditions and cannot comment further at this time.
- DFO makes reports on the numbers of sea lice at BC aquaculture farms available to the public at www.dfo-mpo.gc.ca/aquaculture/protect-protege/parasites-eng.html.

From: Waddington, Zac
Sent: May-04-18 2:31 PM
To: Rainer, Michelle
Cc: Sandberg, Krista; Keith, Ian
Subject: RE: Media request on sea lice

Very interesting timing. We are indeed aware of this and I just finished chatting with Ian about the lice management in Clayoquot and first thing next week we are meeting [REDACTED] The waters are muddied a bit since they submitted a series of plans for sites over threshold back in Jan and Feb which involved the use of Paramove (peroxide). However, the use of Paramove requires a Pesticide Use Permit, issued by the province. This was expected to be in place before the outmigration period, but is still pending. So Cermaq moved to harvesting as a management action, which is acceptable; [REDACTED]

So the short answer is that they are over, we don't yet know if they can be held at fault for this. They also had some sub-par SLICE treatments which has further exacerbated the lice problem.

I'm not sure what more we can/should say about it at this time. Perhaps the best thing to say is:

"DFO regulators are aware of the lice exceedances in Clayoquot and have been in ongoing discussions with Cermaq since the beginning of 2018. Cermaq has faced challenges with attaining a Pesticide Use Permit for Paramove (hydrogen

peroxide bath), which is within provincial jurisdiction. DFO strongly encourages an Integrated Pest Management approach to sea lice management, and a key component of that is the availability and rotational use of numerous lice control techniques. The public opposition to the use of hydrogen peroxide is ill-founded and directly impacting the effective management of lice by salmon farmers [I understand if you don't want to include this last sentence-but it's true].

We cannot comment further at this time since the management of lice at farms in Clayoquot by Cermaq is currently being investigated to determine if there has been non-compliance with the licence conditions. "

This should definitely be reviewed by Adrienne and Allison before going out.

Zac

From: Rainer, Michelle
Sent: May-04-18 1:37 PM
To: Waddington, Zac
Cc: Sandberg, Krista
Subject: Media request on sea lice

Hi Zac,
Can you help with this request today? Or Krista? Sorry, busy day!
Thanks,
Michelle

From: [REDACTED]
Sent: May-04-18 12:19 PM
To: RHQ - Media.PAC
Subject: CBC News request

Hello,

The current reporting for sea lice at Cermac Canada salmon farms in Clayoquot Sound shows levels well over the threshold for treatment at about half of the 14 farms. I'm seeking comment on whether this is a concern and whether it could impact wild salmon in the area.

Thanks,

[REDACTED]
CBC Victoria

Phone: [REDACTED]

Cell: [REDACTED]

s.19(1)

Paylor, Adrienne

From: Paylor, Adrienne
Sent: May-07-18 9:38 AM
To: Webb, Allison
Cc: Waddington, Zac
Subject: FW: URGENT: sea lice media lines for approval - so sorry - need your help with this. My apologies, but please call me and I can type up.

Zac has provided a summary below related to briefing up Andy (I know you send something Friday night but I'm sure this will be ongoing). As my other email this morning indicated the media inquiry came from Cermaq's own posting and likely [REDACTED] sampling. We are just in the process of posting our Audit and industry reported numbers on sea lice for March 2018 today.
Adrienne

From: Waddington, Zac
Sent: Monday, May 07, 2018 9:27 AM
To: Paylor, Adrienne
Subject: RE: URGENT: sea lice media lines for approval - so sorry - need your help with this. My apologies, but please call me and I can type up.

Here's a brief summary of my understanding of the situation to date. Please forward or edit as you wish.

Based on the first article I was sent from Michelle R., it looks like this was initially brought to the media's attentions by Cermaq's own reporting (see : <https://www.cermaq.com/wps/wcm/connect/cermaq-ca/cermaq-canada/our-promise/public-reporting/>). We have been aware of the ongoing issues with sea lice management in Clayoquot. The use of SLICE has had sub-par effects, and so lice control with that product is not currently an option. The public opposition to peroxide has prevented the use of this product in Clayoquot up to this point. Therefore, the only management action left to Cermaq was harvesting, which they committed to doing at the capacity of the plant beginning in February. We would like to confirm that they indeed have met this commitment, [REDACTED]

Based on other incidences when farms have been above threshold during the outmigration, it does seem to be correlated with elevated lice numbers on out-migrating smolts. The species of salmon known to be in the area of (all except pinks), are known to be highly resistant to lice infection which is fortunate. [REDACTED]

Zac

From: Paylor, Adrienne
Sent: May-07-18 8:17 AM
To: Blasco, Nathan; Sandberg, Krista; Waddington, Zac
Subject: FW: URGENT: sea lice media lines for approval - so sorry - need your help with this. My apologies, but please call me and I can type up.

We are briefing up as a result of the media inquiry below so will need more info for Andy and RDG.
Adrienne

From: Webb, Allison
Sent: Friday, May 04, 2018 5:02 PM

s.19(1)
s.21(1)(a)
s.21(1)(b)

To: Paylor, Adrienne

Subject: FW: URGENT: sea lice media lines for approval - so sorry - need your help with this. My apologies, but please call me and I can type up.

Allison Webb, Director / Directrice
Aquaculture Management / Gestion de l'aquaculture
Fisheries Management Branch / Direction de la gestion des pêches
Fisheries and Oceans Canada / Pêches et Océans Canada
200 - 401 Burrard St / Rue Burrard, Vancouver BC / C.B. V6C 3S4 Canada
604-666-7009
Allison.webb@dfo-mpo.gc.ca

From: Thomson, Andrew

Sent: 2018-May-04 4:35 PM

To: Webb, Allison

Subject: Fw: URGENT: sea lice media lines for approval

Will need to send an email to RDG on the issue as well. Can you do up a short summary of how bad the levels are and what's being done about it.

When did we post the sea lice numbers - is this something we should have flagged as likely to cause attention?

Andrew J L Thomson

Regional Director | Directeur Régionale
Fisheries Management Branch | Direction de la gestion des pêches
Pacific Region | Région du Pacifique
Fisheries & Oceans Canada | Pêches et Océans Canada

Suite 200 – 401 Burrard St.
Vancouver, BC, Canada V6C 3S4
andrew.thomson@dfo-mpo.gc.ca
Telephone | Téléphone 604.666.0751
Facsimile | Télécopieur 250.666.8069
Government of Canada | Gouvernement du Canada.

From: Rainer, Michelle <Michelle.Rainer@dfo-mpo.gc.ca>

Sent: Friday, May 4, 2018 4:27 PM

s.19(1)

To: Thomson, Andrew

Cc: Bate, Dan; Girouard, Louise

Subject: URGENT: sea lice media lines for approval

Hi Andy,

Sorry for all the “urgents” today! Can you please review ASAP? Please cc Dan and Louise on response.

Thanks,

Michelle

Issue: [REDACTED] CBC Victoria [REDACTED]

Parksville Qualicum Beach News, [REDACTED] Looking for response on high levels of sea lice reported at Cermaq Canada farms in BC's Clayoquot area. See press release issued May 5 by Clayoquot Action Campaigns, provided below.

Deadline: Friday, May 5, 4:00 p.m.: PST

Recommendation: email approved response

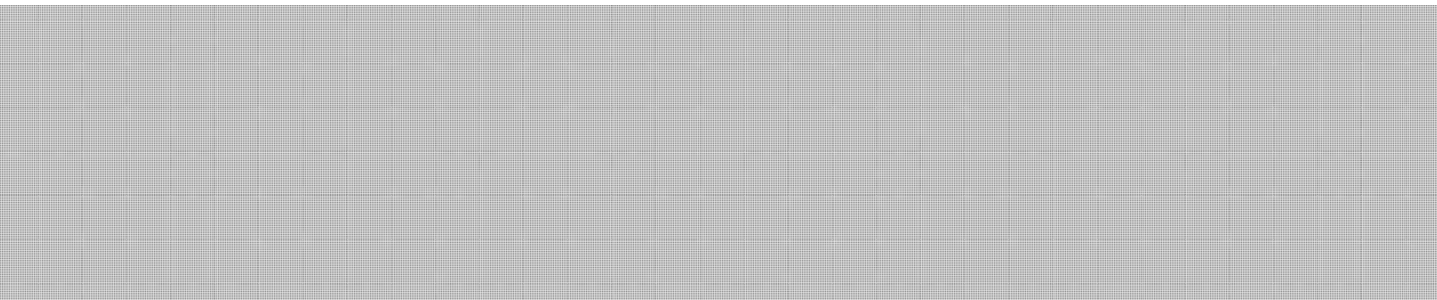
Approved by: Zac Waddington, Allison Webb, Claire Doucette

Media lines:

- DFO is aware of the sea lice exceedances at Cermaq Canada's facilities in Clayoquot and has been in ongoing discussions with the company since January 2018 about measures to reduce sea lice levels.
 - Under the Pacific Aquaculture Regulations, DFO requires salmon farming companies to regularly monitor and manage sea lice levels at their facilities in BC. DFO also regularly conducts assessments of sea lice abundance at these facilities.
 - Companies in BC must submit a lice reduction plan if monitoring shows sea lice levels higher than three motile sea lice per farmed fish during the wild salmon outmigration period from March 1 to June 30 of each year. Motile lice are those at the free-moving stages of their life cycle.
 - Salmon farming companies use an in-feed therapeutant called SLICE (emamectin benzoate) to reduce lice abundance. In cases where the use of SLICE does not result in adequate reduction of sea lice, companies can apply to the province of British Columbia for a permit to use alternative treatments, including Paramove (a hydrogen peroxide bath).
 - Cermaq has applied for a permit but has not yet obtained one from the province of BC. Please contact Cermaq or the Province of BC's Ministry of Agriculture for further information on this process.
 - Hydrogen peroxide is widely used around the world, including elsewhere on Canada's west coast, with excellent effect and no demonstrable effects to the ecosystem. This pesticide is not absorbed by the fish and is non-toxic to humans. It also dissipates as a neutralized substance quickly in the environment and causes no discernible far-field effect.
-
- DFO is investigating the management of lice at farms in Clayoquot by Cermaq Canada to determine if there has been non-compliance with the licence conditions and cannot comment further at this time.
 - DFO makes reports on the numbers of sea lice at BC aquaculture farms available to the public at www.dfo-mpo.gc.ca/aquaculture/protect-protege/parasites-eng.html.

FOR IMMEDIATE RELEASE:

Salmon lice outbreak could devastate Clayoquot salmon





-30-

Clayoquot Action (

High res photos of Clayoquot May 2018 juvenile salmon with lice and Cermaq salmon lice graphs available here:

<https://drive.google.com/drive/folders/1ps-GumjM4j7RmsYT-kVu1GjJR2ojltqz?usp=sharing>

Cermaq's public reporting webpage: <https://www.cermaq.com/wps/wcm/connect/cermaq-ca/cermaq-canada/our-promise/public-reporting/>

Bate, Dan

From: Bate, Dan
Sent: May-07-18 10:11 AM
To: Rainer, Michelle
Cc: Girouard, Louise
Subject: FW: For approval: Sea lice media lines for approval

Hey Michelle – Bonnie's suggesting removing the part in yellow.
Unless we get more calls/inquiries today I think we're OK to hang onto it in region – we can assess as the day goes on.

Dan

From: Antcliffe, Bonnie
Sent: May-07-18 10:09 AM
To: Bate, Dan
Cc: Johal, Sharan; Kaba, Kyle; Girouard, Louise; Reid, Rebecca
Subject: RE: For approval: Sea lice media lines for approval

Sorry – I did review and thought I responded. Maybe I didn't hit send.

Only concern is part in yellow – should we be speaking on behalf of province

Bonnie Antcliffe

Associate Regional Director General
Pacific Region
Fisheries and Oceans Canada / Government of Canada
bonnie.antcliffe@dfo-mpo.gc.ca / Tel: 604-666-0920

Directrice générale régionale associée
Région du Pacifique
Pêches et Océans Canada / Gouvernement du Canada
bonnie.antcliffe@dfo-mpo.gc.ca / Tél: 604-666-0920

From: Bate, Dan
Sent: May-07-18 9:09 AM
To: Antcliffe, Bonnie; Reid, Rebecca
Cc: Johal, Sharan; Kaba, Kyle; Girouard, Louise
Subject: RE: For approval: Sea lice media lines for approval

Hi Bonnie – didn't hear back to you on this one on Friday.. can you let us know?

Thanks,
Dan

From: Bate, Dan
Sent: May-04-18 4:38 PM
To: Antcliffe, Bonnie
Cc: Johal, Sharan; Kaba, Kyle; Girouard, Louise
Subject: For approval: Sea lice media lines for approval

Hi Bonnie – one more for you today.
Could you approve the following.

Thanks,
Dan

Issue: [REDACTED] CBC Victoria [REDACTED] Parksville Qualicum Beach News, ([REDACTED]) Looking for response on high levels of sea lice reported at Cermaq Canada farms in BC's Clayoquot area. See press release issued May 5 by Clayoquot Action Campaigns, <https://clayoquotaction.org/2018/05/clayoquot-salmon-lice-outbreak-devastating/>

Deadline: Friday, May 5, 4:00 p.m. PST

Recommendation: email approved response

Approved by: Zac Waddington, Allison Webb, Claire Doucette, Andrew Thompson, Dan Bate

Media lines:

- DFO is aware of the sea lice exceedances at Cermaq Canada's facilities in Clayoquot and has been in ongoing discussions with the company since January 2018 about measures to reduce sea lice levels.
- Under the Pacific Aquaculture Regulations, DFO requires salmon farming companies to regularly monitor and manage sea lice levels at their facilities in BC. DFO also regularly conducts assessments of sea lice abundance at these facilities.
- Companies in BC must submit a lice reduction plan if monitoring shows sea lice levels higher than three motile sea lice per farmed fish during the wild salmon outmigration period from March 1 to June 30 of each year. Motile lice are those at the free-moving stages of their life cycle.
- Salmon farming companies use an in-feed therapeutant called SLICE (emamectin benzoate) to reduce lice abundance. In cases where the use of SLICE does not result in adequate reduction of sea lice, companies can apply to the province of British Columbia for a permit to use alternative treatments, including Paramove (a hydrogen peroxide bath).
- Cermaq has applied for a permit but has not yet obtained one from the province of BC. Please contact Cermaq or the Province of BC's Ministry of Agriculture for further information on this process.
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- DFO is investigating the management of lice at farms in Clayoquot by Cermaq Canada to determine if there has been non-compliance with the licence conditions and cannot comment further at this time.
- DFO makes reports on the numbers of sea lice at BC aquaculture farms available to the public at www.dfo-mpo.gc.ca/aquaculture/protect-protege/parasites-eng.html

Dan Bate

Team Lead, Communications
Fisheries and Oceans Canada Pacific Region / Canadian Coast Guard / Government of Canada
Dan.Bate@dfo-mpo.gc.ca / Tél: (604) 775-8809 / Cell: [REDACTED]

s.16(2)(c)

s.19(1)

Chef d'équipe, communications
Pêches et Océans Canada, région du Pacifique / Garde côtière canadienne / Gouvernement du Canada
Dan.Bate@dfo-mpo.gc.ca / Tél : (604) 775-8809 / Tél. cell. : [REDACTED]

Waddington, Zac

From: Sandberg, Krista
Sent: May-07-18 10:29 AM
To: Waddington, Zac
Subject: lice levels and farm inventory in Clayoquot
Attachments: Sea Lice - Clayoquot.xls

Zac,

Attached are graphs of lice abundance vs. farm inventory with Slice treatments for Clayoquot. I've also added a graph of inventory of all sites to see which farms were harvesting during the outmigration.

Krista.

Krista Sandberg

Aquaculture Data Manager | Gestionnaire de données sur l'aquaculture
Aquaculture Management Division | Gestion de l'aquaculture
Fisheries and Oceans Canada | Pêches et Océans Canada
krista.sandberg@dfo-mpo.gc.ca
Office | Bureau 250-286-5835
Cellular | Cellulaire [REDACTED]



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s.16(2)(c)

**Pages 560 to / à 568
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Waddington, Zac

From: Webb, Allison
Sent: May-07-18 12:46 PM
To: Sandberg, Krista
Cc: Paylor, Adrienne; Waddington, Zac
Subject: RE: February and March Sea Lice Reports

Hi – This is locked for editing by Zac so I can't access it. Tx.

Allison Webb, Director / Directrice
Aquaculture Management / Gestion de l'aquaculture
Fisheries Management Branch / Direction de la gestion des pêches
Fisheries and Oceans Canada / Pêches et Océans Canada
200 - 401 Burrard St / Rue Burrard, Vancouver BC / C.B. V6C 3S4 Canada
604-666-7009
Allison.webb@dfo-mpo.gc.ca

From: Sandberg, Krista
Sent: 2018-May-07 8:45 AM
To: Webb, Allison
Subject: FW: February and March Sea Lice Reports

Hi Allison,

It appears that it is somewhat urgent that we get these sea lice reports posted. February and March for your approval.

Cheers,
Krista.

Krista Sandberg
Office | Bureau 250-286-5835
Cellular | Cellulaire [REDACTED]



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From: Paylor, Adrienne
Sent: Monday, May 07, 2018 8:13 AM
To: Sandberg, Krista
Subject: RE: February and March Sea Lice Reports

s.16(2)(c)

Approved. Can you call me when you get this at [REDACTED]
Thx Adrienne

From: Sandberg, Krista
Sent: Friday, May 04, 2018 2:17 PM
To: Paylor, Adrienne
Subject: FW: February and March Sea Lice Reports

February/March sea lice reports for your review: [X:\1. PUBLIC REPORTING\Sea Lice\Monthly Farm Level \(A\)\2018\2018 Farm Level Sea Lice Summary.xlsx](#)

Krista Sandberg

Office | Bureau 250-286-5835

Cellular | Cellulaire



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From: Waddington, Zac

Sent: Friday, May 04, 2018 2:07 PM

To: Sandberg, Krista

Subject: RE: February and March Sea Lice Reports

I have reviewed the reports and they are good to go. I've made a few comments if you care to see. We are following up with Cermaq first thing next week on their lice management in Clayoquot.

Zac

From: Sandberg, Krista

Sent: May-03-18 3:55 PM

To: Waddington, Zac

Subject: FW: February and March Sea Lice Reports

Reminder that this is still awaiting your approval

Krista Sandberg

Office | Bureau 250-286-5835

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From: Sandberg, Krista

Sent: Wednesday, April 25, 2018 2:09 PM

To: Waddington, Zac

Subject: February and March Sea Lice Reports

Hi Zac,

The February and March Sea Lice reports are ready for your review.

Quite a few exceedances in the Clayoquot area, as you are aware. In March there are quite a few instances where Marine Harvest did H2O2 treatments. I split these pre-/post-treatment. Also, there were quite a few single pens counted by Cermaq in the last couple days of March. I did not include these and suspect they may be moved over to the April counts.

Calculator: X:\1. PUBLIC REPORTING\Sea Lice\Monthly Farm Level (A)\2018\SL Farm Level Calculator 2018.xls

Summary: X:\1. PUBLIC REPORTING\Sea Lice\Monthly Farm Level (A)\2018\2018 Farm Level Sea Lice Summary.xlsx

Krista.

s.16(2)(c)

Krista Sandberg

Aquaculture Data Manager | Gestionnaire de données sur l'aquaculture

Aquaculture Management Division | Gestion de l'aquaculture

Fisheries and Oceans Canada | Pêches et Océans Canada

krista.sandberg@dfo-mpo.gc.ca

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s.16(2)(c)

No further information has been removed or severed from this page

Waddington, Zac

From: Waddington, Zac
Sent: May-07-18 3:38 PM
To: Keith, Ian; Paylor, Adrienne
Cc: Sandberg, Krista
Subject: FW: improved sea lice figures
Attachments: Sea Lice - Clayoquot.xls

FYI. Krista has compiled the data from Clayoquot looking at SLICE use, inventory and lice numbers. It's very interesting to see the sub-par performance of SLICE on many of the farms, and harvesting trends. I would like to chat more about this on Wednesday when I'm back from the field.

Zac

From: Sandberg, Krista
Sent: May-07-18 2:44 PM
To: Waddington, Zac
Subject: improved sea lice figures

Krista Sandberg

Aquaculture Data Manager | Gestionnaire de données sur l'aquaculture
Aquaculture Management Division | Gestion de l'aquaculture
Fisheries and Oceans Canada | Pêches et Océans Canada
krista.sandberg@dfo-mpo.gc.ca
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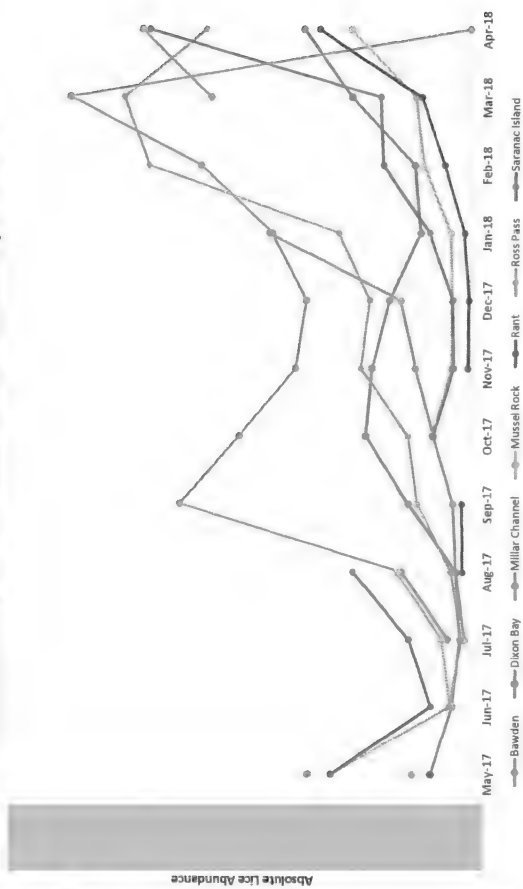
End of Month Inventory												
	May-17	Jun-17	Jul-17	Aug-17	Sep-17	Oct-17	Nov-17	Dec-17	Jan-18	Feb-18	Mar-18	Apr-18
Bawden												
Dixon Bay												
Millar Channel												0
Mussel Rock												
Rant												
Ross Pass												0
Saranac Island												

Mid-Month Inventory												
	May-17	Jun-17	Jul-17	Aug-17	Sep-17	Oct-17	Nov-17	Dec-17	Jan-18	Feb-18	Mar-18	Apr-18
Bawden												
Dixon Bay												
Millar Channel												
Mussel Rock												
Rant												
Ross Pass												
Saranac Island												

Average Motile Abundance												
	May-17	Jun-17	Jul-17	Aug-17	Sep-17	Oct-17	Nov-17	Dec-17	Jan-18	Feb-18	Mar-18	Apr-18
Bawden	1.85	0.18	0.33	0.48	2.14	3.62	3.42	2.82	2.11	3.43	9.08	12.43
Dixon Bay	1.34	0.60	0.33	0.48	2.14	3.62	3.42	2.82	2.11	3.43	9.08	13.92
Millar Channel	4.92	0.68	2.11	8.96	7.17	5.43	5.11	6.20	10.07	23.55		
Mussel Rock		0.55	0.81	2.07	0.30	1.14	0.54	0.52	0.57	1.39	1.75	4.26
Rant	1.26			0.26	0.30	0.08	0.08	0.05	0.22	1.00	1.93	6.01
Ross Pass	4.92	0.72	0.30	0.70	2.00	2.37	4.17	3.86	5.06	12.70	15.14	25.08
Saranac Island	3.93	1.12	1.74	3.34		1.07	0.47	0.50	1.19	2.65	3.17	12.87

Total # Lice on Farm												
	May-17	Jun-17	Jul-17	Aug-17	Sep-17	Oct-17	Nov-17	Dec-17	Jan-18	Feb-18	Mar-18	Apr-18
Bawden												
Dixon Bay												
Millar Channel												0
Mussel Rock												
Rant												
Ross Pass												
Saranac Island												

CLAYOQUOT SOUND - Absolute Sea Lice Inventory on Farms



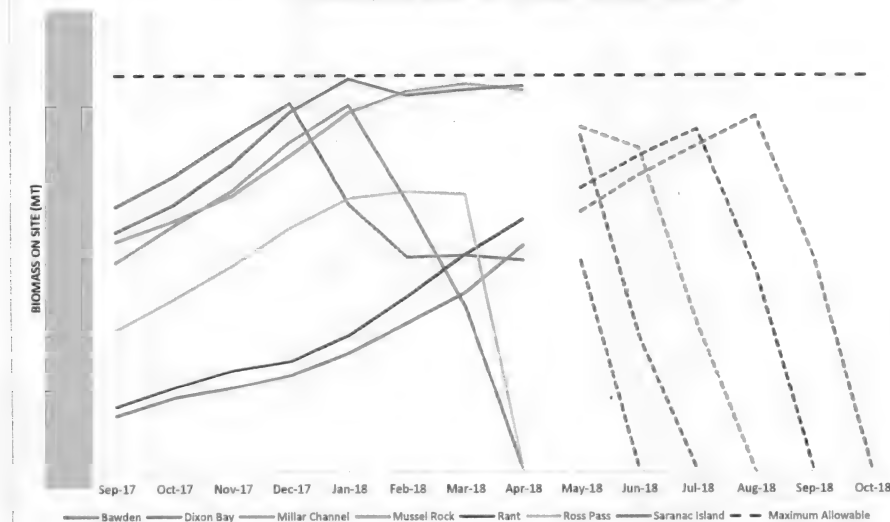
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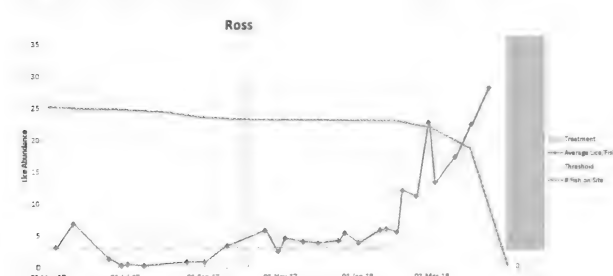
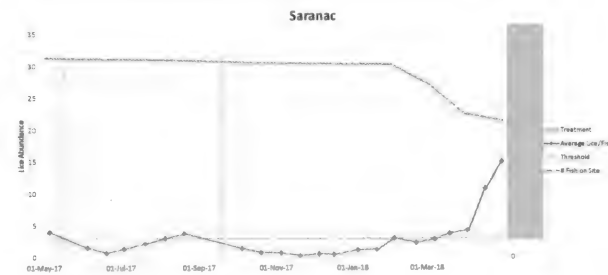
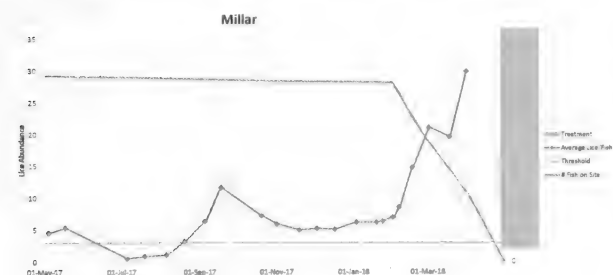
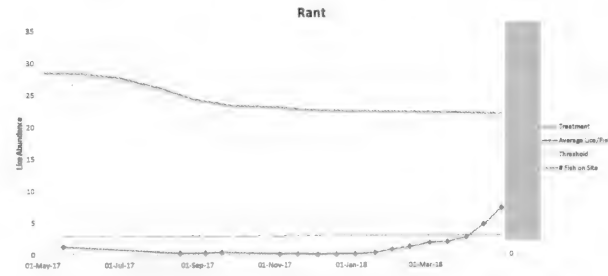
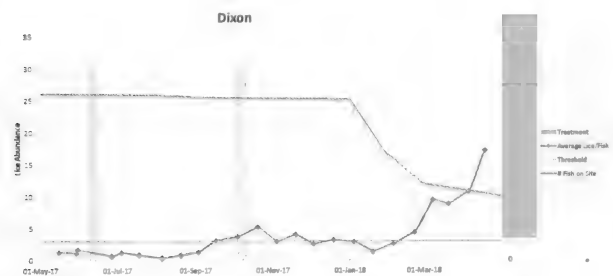
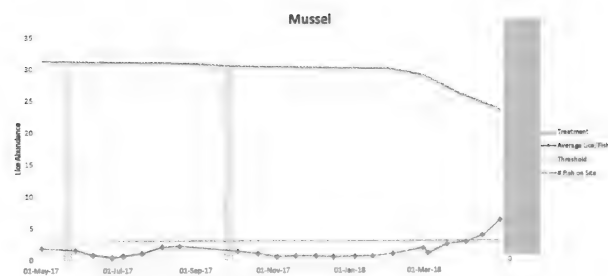
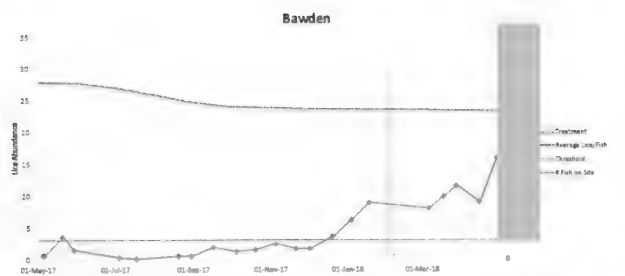
<i>Facility Name</i>	<i>Treatment Start Date</i>	<i>Treatment End Date</i>
Bawden Point, Herbert Inlet		
Dixon Point, Shelter Inlet	09-Jun-17	15-Jun-17
Dixon Point, Shelter Inlet	05-Oct-17	11-Oct-17
Fortune Channel, East side Warn Bay	12-Feb-17	18-Feb-17
Millar Channel, 2km S Hayden Passage		
Millar Channel, 2km S Hayden Passage	21-Sep-17	27-Sep-17
Mussel Rock, Clayoquot Sound	19-May-17	25-May-17
Mussel Rock, Clayoquot Sound	24-Sep-17	30-Sep-17
Rant Point, Clayoquot Sound		
Rant Point, Clayoquot Sound		
Raza Island, Raza Passage	25-Jan-17	31-Jan-17
Raza Island, Raza Passage	16-Jan-17	22-Jan-17
Ross Pass, Northeast McKay Island		
Ross Pass, Northeast McKay Island	01-Oct-17	07-Oct-17
Saranac Island, NW of Meares Island	13-May-17	19-May-17
Saranac Island, NW of Meares Island	16-Sep-17	23-Sep-17
West Side, Bedwell Sound	05-Feb-17	11-Feb-17

	Actual								Predicted					
	Sep-17	Oct-17	Nov-17	Dec-17	Jan-18	Feb-18	Mar-18	Apr-18	May-18	Jun-18	Jul-18	Aug-18	Sep-18	Oct-18
Bawden	374	493	562	646	796	996	1196	1511	No info severed here					
Dixon Bay	1769	1968	2222	2456	1784	1434	1444	1413						
Millar Channel	1395	1638	1873	2198	2443	1802	1102	0						
Mussel Rock	1536	1673	1843	2111	2397	2537	2587	2545						
Rant	434	562	678	739	915	1171	1451	1684						
Ross Pass	945	1150	1373	1628	1824	1867	1849	0						
Saranac Island	1598	1780	2050	2399	2619	2509	2546	2572						
Maximum Allowable	2640	2640	2640	2640	2640	2640	2640	2640	2640	2640	2640	2640	2640	2640
Bawden - predicted	No info severed here								1736	1981	2177	2371	1427	0
Dixon Bay - predicted									1408	0				
Millar Channel - predicted									2300	2159	984	0		
Mussel Rock - predicted									1893	2109	2284	1349	0	
Rant - predicted														
Ross Pass - predicted														
Saranac Island - predicted									2243	897	0			

CLAYOQUOT SOUND - CERMAQ HARVESTING



s.20(1)(b)



s.20(1)(b)

	Bawden		Dixon		Millar		Mussel		Rant		Ross		Saranac		Threshold
	Average	Licereatme/Fish on Site	Average	Licereatme/Fish on Site	Average	Licereatme/Fish on Site	Average	Licereatme/Fish on Site	Average	Licereatme/Fish on Site	Average	Licereatme/Fish on Site	Average	Licereatme/Fish on Site	
01-May-17							1.79								3
02-May-17															3
03-May-17															3
04-May-17					4.53								3.93		3
05-May-17	0.58														3
06-May-17															3
07-May-17											3.09				3
08-May-17															3
09-May-17															3
10-May-17															3
11-May-17															3
12-May-17															3
13-May-17													30		3
14-May-17													30		3
15-May-17			1.23										30		3
16-May-17													30		3
17-May-17					5.3				1.26				30		3
18-May-17													30		3
19-May-17							30						30		3
20-May-17	3.5						30						30		3
21-May-17							30				6.74				3
22-May-17							30								3
23-May-17							30								3
24-May-17							30								3
25-May-17							30		30						3
26-May-17															3
27-May-17															3
28-May-17							1.49								3
29-May-17	1.47		1.13												3
30-May-17			1.65												3
31-May-17															3
01-Jun-17															3
02-Jun-17															3
03-Jun-17													1.51		3
04-Jun-17															3
05-Jun-17															3
06-Jun-17															3
07-Jun-17															3
08-Jun-17															3
09-Jun-17			30												3
10-Jun-17			30												3
11-Jun-17			30				0.76								3
12-Jun-17			30												3
13-Jun-17			30												3
14-Jun-17			30												3
15-Jun-17	30		30		30						30				3
16-Jun-17															3
17-Jun-17															3
18-Jun-17											1.24				3
19-Jun-17													0.72		3
20-Jun-17															3
21-Jun-17															3
22-Jun-17															3
23-Jun-17															3
24-Jun-17															3
25-Jun-17															3
26-Jun-17			0.6				0.34								3
27-Jun-17															3
28-Jun-17											0.2				3
29-Jun-17															3
30-Jun-17															3
01-Jul-17															3
02-Jul-17															3
03-Jul-17											0.41		1.33		3
04-Jul-17	0.29		1.2		0.52		0.59								3
05-Jul-17															3
06-Jul-17															3
07-Jul-17															3
08-Jul-17															3
09-Jul-17															3
10-Jul-17															3
11-Jul-17															3
12-Jul-17															3
13-Jul-17															3
14-Jul-17															3
15-Jul-17															3
16-Jul-17											0.19				3
17-Jul-17															3
18-Jul-17	0.07		0.77												3
19-Jul-17					0.83										3
20-Jul-17							1.03						2.14		3
21-Jul-17															3
22-Jul-17															3
23-Jul-17															3
24-Jul-17															3
25-Jul-17															3
26-Jul-17															3
27-Jul-17															3
28-Jul-17															3

29-Jul-17							3
30-Jul-17							3
31-Jul-17							3
01-Aug-17							3
02-Aug-17							3
03-Aug-17							3
04-Aug-17							3
05-Aug-17	0.27	1.03	2			2.97	3
06-Aug-17							3
07-Aug-17							3
08-Aug-17							3
09-Aug-17							3
10-Aug-17							3
11-Aug-17							3
12-Aug-17							3
13-Aug-17							3
14-Aug-17							3
15-Aug-17							3
16-Aug-17							3
17-Aug-17					0.26		3
18-Aug-17							3
19-Aug-17			2.14		0.7		3
20-Aug-17	0.48	0.69	3.18			3.71	3
21-Aug-17							3
22-Aug-17							3
23-Aug-17							3
24-Aug-17							3
25-Aug-17							3
26-Aug-17							3
27-Aug-17							3
28-Aug-17							3
29-Aug-17							3
30-Aug-17	0.52						3
31-Aug-17							3
01-Sep-17					0.71		3
02-Sep-17							3
03-Sep-17	1.23						3
04-Sep-17							3
05-Sep-17		6.32					3
06-Sep-17							3
07-Sep-17				0.22			3
08-Sep-17							3
09-Sep-17							3
10-Sep-17							3
11-Sep-17							3
12-Sep-17							3
13-Sep-17							3
14-Sep-17							3
15-Sep-17							3
16-Sep-17					30		3
17-Sep-17	1.87	3.04				30	3
18-Sep-17						30	3
19-Sep-17		11.59				30	3
20-Sep-17						30	3
21-Sep-17					0.38	3.29	3
22-Sep-17		30					3
23-Sep-17		30					3
24-Sep-17		30	30				3
25-Sep-17		30	30				3
26-Sep-17		30	30				3
27-Sep-17		30	30				3
28-Sep-17			30				3
29-Sep-17			30				3
30-Sep-17							3
01-Oct-17						30	3
02-Oct-17						30	3
03-Oct-17						30	3
04-Oct-17						30	3
05-Oct-17	1.23	3.62	1.33			30	3
06-Oct-17		30				30	3
07-Oct-17		30				30	3
08-Oct-17		30				30	3
09-Oct-17		30					3
10-Oct-17		30					3
11-Oct-17		30					3
12-Oct-17							3
13-Oct-17							3
14-Oct-17							3
15-Oct-17							3
16-Oct-17							3
17-Oct-17							3
18-Oct-17							3
19-Oct-17							3
20-Oct-17	1.51	5.14	7.17	0.96	5.66	0.74	3
21-Oct-17							3
22-Oct-17							3
23-Oct-17							3
24-Oct-17							3
25-Oct-17							3
26-Oct-17							3
27-Oct-17							3

s.20(1)(b)

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28-Oct-17							3
29-Oct-17							3
30-Oct-17					2.37		3
31-Oct-17							3
01-Nov-17		5.9					3
02-Nov-17							3
03-Nov-17							3
04-Nov-17	2.89		0.48				3
05-Nov-17	2.41			0.07	4.43	0.68	3
06-Nov-17							3
07-Nov-17							3
08-Nov-17							3
09-Nov-17							3
10-Nov-17							3
11-Nov-17							3
12-Nov-17							3
13-Nov-17							3
14-Nov-17							3
15-Nov-17							3
16-Nov-17							3
17-Nov-17							3
18-Nov-17							3
19-Nov-17	3.96	4.96	0.61	0.09	3.9		3
20-Nov-17						0.27	3
21-Nov-17	1.68						3
22-Nov-17							3
23-Nov-17							3
24-Nov-17							3
25-Nov-17							3
26-Nov-17							3
27-Nov-17							3
28-Nov-17							3
29-Nov-17							3
30-Nov-17							3
01-Dec-17					3.68		3
02-Dec-17	1.67						3
03-Dec-17	2.5	5.18					3
04-Dec-17							3
05-Dec-17			0.59	0.03		0.54	3
06-Dec-17							3
07-Dec-17							3
08-Dec-17							3
09-Dec-17							3
10-Dec-17							3
11-Dec-17							3
12-Dec-17							3
13-Dec-17							3
14-Dec-17							3
15-Dec-17							3
16-Dec-17							3
17-Dec-17		5.03			4.03	0.46	3
18-Dec-17							3
19-Dec-17	3.14		0.46				3
20-Dec-17	3.52			0.07			3
21-Dec-17					5.23		3
22-Dec-17							3
23-Dec-17							3
24-Dec-17							3
25-Dec-17							3
26-Dec-17							3
27-Dec-17							3
28-Dec-17							3
29-Dec-17							3
30-Dec-17							3
31-Dec-17							3
01-Jan-18					3.67		3
02-Jan-18							3
03-Jan-18		6.17					3
04-Jan-18	6.18	2.88		0.11			3
05-Jan-18			0.54			1.13	3
06-Jan-18							3
07-Jan-18							3
08-Jan-18							3
09-Jan-18							3
10-Jan-18							3
11-Jan-18							3
12-Jan-18							3
13-Jan-18							3
14-Jan-18							3
15-Jan-18							3
16-Jan-18							3
17-Jan-18							3
18-Jan-18	8.89						3
19-Jan-18	1.33	6.14	0.59		5.68		3
20-Jan-18				0.32		1.24	3
21-Jan-18							3
22-Jan-18							3
23-Jan-18							3
24-Jan-18		6.29			5.83		3
25-Jan-18				s.20(1)(b)			3
26-Jan-18							3

27-Jan-18							3
28-Jan-18							3
29-Jan-18							3
30-Jan-18							3
31-Jan-18							3
01-Feb-18	30		6.97		5.4		3
02-Feb-18	30			0.81			3
03-Feb-18	30					2.97	3
04-Feb-18	30	2.56		0.96			3
05-Feb-18	30						3
06-Feb-18	30		8.5		11.9		3
07-Feb-18	30						3
08-Feb-18							3
09-Feb-18							3
10-Feb-18							3
11-Feb-18							3
12-Feb-18							3
13-Feb-18							3
14-Feb-18							3
15-Feb-18							3
16-Feb-18				1.19			3
17-Feb-18			14.73		10.97		3
18-Feb-18							3
19-Feb-18						2.33	3
20-Feb-18							3
21-Feb-18		4.31					3
22-Feb-18							3
23-Feb-18							3
24-Feb-18							3
25-Feb-18							3
26-Feb-18					22.52		3
27-Feb-18							3
28-Feb-18				1.83			3
01-Mar-18							3
02-Mar-18			20.97				3
03-Mar-18							3
04-Mar-18				1.05			3
05-Mar-18					1.83		3
06-Mar-18	7.98				13.17		3
07-Mar-18						2.84	3
08-Mar-18		9.42					3
09-Mar-18							3
10-Mar-18							3
11-Mar-18							3
12-Mar-18							3
13-Mar-18							3
14-Mar-18							3
15-Mar-18							3
16-Mar-18							3
17-Mar-18							3
18-Mar-18	9.83		19.59		1.97		3
19-Mar-18				2.44		3.74	3
20-Mar-18		8.74			17.11		3
21-Mar-18							3
22-Mar-18							3
23-Mar-18							3
24-Mar-18							3
25-Mar-18							3
26-Mar-18							3
27-Mar-18							3
28-Mar-18	11.5						3
29-Mar-18							3
30-Mar-18							3
31-Mar-18							3
01-Apr-18			29.78				3
02-Apr-18							3
03-Apr-18				2.79	2.69	22.26	3
04-Apr-18						4.22	3
05-Apr-18		10.71					3
06-Apr-18							3
07-Apr-18							3
08-Apr-18							3
09-Apr-18							3
10-Apr-18							3
11-Apr-18							3
12-Apr-18							3
13-Apr-18							3
14-Apr-18							3
15-Apr-18	9.01						3
16-Apr-18				3.83	4.71	27.91	3
17-Apr-18						10.78	3
18-Apr-18		17.13					3
19-Apr-18							3
20-Apr-18							3
21-Apr-18							3
22-Apr-18							3
23-Apr-18							3
24-Apr-18							3
25-Apr-18							3
26-Apr-18							3
27-Apr-18							3

s.20(1)(b)

28-Apr-18
29-Apr-18 15.86
30-Apr-18



0 6.17



7.31



0 14.97



3
3
3

s.20(1)(b)

Jones, Simon

From: Jones, Simon
Sent: Tuesday, May 8, 2018 2:20 PM
To: Rainer, Michelle
Subject: RE: Media inquiry on sea lice

Follow Up Flag: Follow up
Flag Status: Flagged

Categories: Yellow Category

Hi Michelle,

[REDACTED] called to discuss sea lice biology – especially the effects of sea lice on juvenile salmon. She also asked about why we have sea lice thresholds in place on farms and my thoughts about Paramove.

Cheers,
Simon

From: Rainer, Michelle
Sent: May-08-18 1:44 PM
To: Jones, Simon
Subject: Media inquiry on sea lice

Hi Simon,
Further to the email I cc'd you on just now, the reporter wrote the story linked to below. Hope you don't mind that I sent her your way; I appreciate you might not be available at short notice. I have given her all possible info with regards to Cermaq exceedances and explained that your area is science. If you do end up connecting, please let me know.
Thanks,
Michelle

From: Rainer, Michelle
Sent: May-08-18 11:00 AM
To: [REDACTED]
Cc: RHQ - Media.PAC
Subject: DFO Pacific Region contact

Hi [REDACTED]

I note that you did not receive a response for this story in time for deadline and just want to make sure you have our correct contact info for next time, as we didn't receive a request from you. For fastest response, please email Media.PAC@dfo-mpo.gc.ca. We appreciate receiving requests as early as possible in the day so that we have enough time to meet deadlines.

<https://www.thestar.com/vancouver/2018/05/04/dead-fish-swimming-lice-from-fish-farms-infecting-wild-baby-salmon-in-bc.html>

s.19(1)

I have provided info below related to your story. Would it be possible to update?

DFO is aware of the sea lice exceedances at Cermaq Canada's facilities in Clayoquot and has been in ongoing discussions with the company since January 2018 about measures to reduce sea lice levels.

Under the Pacific Aquaculture Regulations, DFO requires salmon farming companies to regularly monitor and manage sea lice levels at their facilities in BC. DFO also regularly conducts assessments of sea lice abundance at these facilities. Companies in BC must submit a lice reduction plan if monitoring shows sea lice levels higher than three motile sea lice per farmed fish during the wild salmon outmigration period from March 1 to June 30 of each year. Motile lice are those at the free-moving stages of their life cycle.

Salmon farming companies use an in-feed therapeutant called SLICE (emamectin benzoate) to reduce lice abundance. In cases where the use of SLICE does not result in adequate reduction of sea lice, companies can apply to the province of British Columbia for a permit to use alternative treatments, including Paramove (a hydrogen peroxide bath). Please contact Cermaq or the Province of BC's Ministry of Agriculture for further information on this process.

Hydrogen peroxide is widely used around the world, including elsewhere on Canada's west coast, with excellent effect and no demonstrable effects to the ecosystem. This pesticide is not absorbed by the fish and is non-toxic to humans. It also dissipates as a neutralized substance quickly in the environment and causes no discernible far-field effect.

DFO is investigating the management of lice at farms in Clayoquot by Cermaq Canada to determine if there has been non-compliance with the licence conditions and cannot comment further at this time.

DFO makes reports on the numbers of sea lice at BC aquaculture farms available to the public at www.dfo-mpo.gc.ca/aquaculture/protect-protege/parasites-eng.html.

Kind regards,

Michelle Rainer

Communications Advisor | Conseillère en communications

Fisheries and Oceans Canada | Pêches et Océans Canada

200 - 401 Burrard Street, Vancouver, B.C. V6C 3S4 | 200 - 401 rue Burrard, Vancouver, C.-B. V6C 3S4

Telephone | Téléphone [604-775-5065](tel:604-775-5065)

Delaney, Paula

From: Paylor, Adrienne
Sent: May-09-18 2:25 PM
To: Webb, Allison; Doucette, Claire
Subject: FW: Clayoquot Lice Management
Attachments: Draft Letter to Cermaq re-Lice in Clayoquot.docx

Allison and Claire,

Our fish health unit would like to request some additional information from Cermaq regarding sea lice levels in Clayoquot. This information will help inform us regarding adherence to licence conditions. Do you have any concerns with this approach or the wording in the attached?

Thank you,
Adrienne

From: Waddington, Zac
Sent: Wednesday, May 09, 2018 2:11 PM
To: Paylor, Adrienne; Keith, Ian; Manchester, Howie
Subject: Clayoquot Lice Management

We have been monitoring the management of lice in Clayoquot, and have been in discussion with fish health and veterinary staff at Cermaq regarding plans for lice management. These plans have changed throughout early 2018 as a result of ongoing delays with attaining a Pesticide Use Permit for Clayoquot. While we are sympathetic to this challenge, we have some questions to clarify what due diligence and mitigation options have been pursued and exhausted by Cermaq that justify the current state of lice burden on numerous farms in Clayoquot. Specifically:

- Area-based SLICE treatment in late September to early October in Clayoquot had reduced efficacy and duration of effect than is expected at numerous sites. Please demonstrate how appropriate therapeutic SLICE use was ensured as per Merck's Slice Sustainability Project
- How were other treatment measures considered such as fresh water baths, increased processing capacity at other facilities, use of Marine Harvest Canada's Hydrolizer, earlier start to harvest at most affected farms?

Dr. Zac Waddington DVM, B.Env.Sc.(Hons)
Lead Veterinarian - Pacific Region
Fisheries and Oceans Canada | Pêches et Océans Canada
Aquaculture Environmental Operations - Fish Health
Courtenay, British Columbia
Telephone | Téléphone: 250-703-0902
Fax | Télécopieur: 250-703-0921
Zac.Waddington@dfo-mpo.gc.ca

DFO veterinarians have been monitoring the management of lice in Clayoquot, and have been in discussions with fish health and veterinary staff at Cermaq regarding plans for lice management. These plans have changed throughout early 2018 as a result of ongoing delays with attaining a Pesticide Use Permit for peroxide use in Clayoquot. While we are sympathetic to this challenge, we have some questions to clarify what due diligence and mitigation options have been pursued and exhausted by Cermaq that justify the current state of lice burden on numerous farms in Clayoquot. Specifically:

- Area-based SLICE treatment in late September to early October in Clayoquot had reduced efficacy and duration of effect than what is expected at numerous sites. Please demonstrate how appropriate therapeutic SLICE use was ensured as per Merck's Slice Sustainability Project.
- How were other treatment measures considered such as fresh water baths, increased processing capacity at other facilities, use of Marine Harvest Canada's Hydrolicer, an earlier start to harvest at affected farms, and any other options considered?
- Was the assumption that Cermaq would have a PUP for peroxide use before the outmigration period reasonable? If so, please provide evidence to support this.
- What, if any, monitoring of smolt lice burden has Cermaq conducted to monitor for effects on wild salmon smolts?
- Based on our lice data, it appears that farms XXXXX have not had a reduction in "absolute sea lice inventory" as per licence condition 6.4(a).

[details and
confirmation pending Krista's analysis]

s.21(1)(a)

s.21(1)(b)

Manchester, Howie

From: Manchester, Howie
Sent: May-09-18 2:46 PM
To: Charbonneau, Michelle; Waddington, Zac
Subject: RE: Characterizing SL over threshold and Treatments for Bawden, Dixon, Millar and Ross

Thanks for this Michelle.

Hey Zac,

Did you want a similar timeline for Saranac, Mussel and Rant?

Howie

From: Charbonneau, Michelle
Sent: May-09-18 1:29 PM
To: Waddington, Zac
Cc: Manchester, Howie
Subject: RE: Characterizing SL over threshold and Treatments for Bawden, Dixon, Millar and Ross

Hey Zac, I was mistaken about the Slice treatment Feb 2018 at Ross. That did not happen. Sorry, my bad.

I would love to include when they applied for H2O2, and when that was delayed due to public pressure, in the chronology 😊

I revised this:

Bawden

Fish were entered in April 2017.

An exceedance of three motiles was noted in the monthly SL submissions on:

- May 20, 2017 (Failure to notify)
 - Treated with Slice June 2017 according to AAR Tracking Spreadsheet
- Dec 20, 2017
- Jan 4, 2018
- Jan 18, 2018
 - Treated with Slice Feb 1, 2018 according to Compliance tracking sheet for SL (FHE tab notes all pens treated), confirmed in AAR
- March 6, 2018 (Failure to notify, Avg = 7.98) Compliance tracking notes (from monthly SL reporting I assume) that the mitigative action taken is: Treatment Pending
- March 18, 2018 (Avg increased to 9.83) Compliance tracking notes (from monthly SL reporting I assume) that the mitigative action taken is: Treatment Pending
- March 28, 2018 (Avg further increased to 11.5) Compliance tracking notes (from monthly SL reporting I assume) that the mitigative action taken is: Treatment Pending
 - No treatment noted in March
 - April monthly SL not yet submitted.
 - Inventory spreadsheet suggests no harvesting undertaken or even planned yet.

Dixon

Fish were entered in August 2016

An exceedance of three motiles was noted in the monthly SL submissions on:

- Sept 17, 2017
 - Treated with Slice Sept 2017 according to AAR tracking spreadsheet
- Oct 4, 2017
 - Treated with Slice Oct 2017 according to AAR tracking spreadsheet, compliance tracking spreadsheet for SL notes Slice treatment began Oct 5th 2017.
- Nov 19, 2017
- Dec 19, 2017
 - Inventory spreadsheet indicates Dixon began harvesting in Jan 2018
- Feb 21, 2018 (Motiles **Avg = 4.31 going into outmigration period**)
 - Inventory spreadsheet indicates Dixon has [REDACTED] fish still onsite in March.
- Mar 08, 2018 (Failure to notify, Avg=9.42) Compliance tracking notes (from monthly SL reporting I assume) that the mitigative action taken is: Harvest
- Mar 20, 2018 (Slight reduction in Avg = 8.74) Compliance tracking notes (from monthly SL reporting I assume) that the mitigative action taken is: Harvest
 - Inventory spreadsheet predicts Dixon will be empty in June 2018
 - We are scheduled to audit Dixon May 28th.

Millar

Fish were entered in March 2017

An exceedance of three motiles was noted in the monthly SL submissions on:

- May 4, 2017
- May 20, 2017
 - Treated with Slice June 2017 according to AAR tracking spreadsheet, compliance tracking spreadsheet for SL notes Slice treatment began June 2nd 2017.
- August 20, 2017
- Sept 5, 2017
- Sept 18, 2017
 - Treated with Slice Sept 2017 according to AAR tracking spreadsheet, compliance tracking spreadsheet for SL notes Slice treatment began Sept 29th 2017.
- Oct 20, 2017
- Nov 3, 2017
- Nov 19, 2017
- Dec 4, 2017
- Jan 3, 2018
- Jan 19, 2018
- Jan 24, 2018
- Feb 1, 2018
- Feb 6, 2018
- Feb 17, 2018 (Motiles **Avg = 14.73 going into outmigration period**)
 - Inventory Spreadsheet indicates Millar started harvesting in Feb 2018
- Mar 4, 2018 (Failure to notify, Avg=20.97) Compliance tracking notes (from monthly SL reporting I assume) that the mitigative action taken is: Harvest
- Mar 18, 2018 (Avg = 19.59) Compliance tracking notes (from monthly SL reporting I assume) that the mitigative action taken is: Harvest
- Mar 30, 2018 (Avg = 30.10) Compliance tracking notes (from monthly SL reporting I assume) that the mitigative action taken is: Harvest
 - Inventory spreadsheet predicts Millar was scheduled to be empty in April 2018 (not confirmed)
 - Inventory spreadsheet predicts Millar will want to restock [REDACTED]

s.20(1)(b)

Ross

Fish were entered in September 2016

An exceedance of three motiles was noted in the monthly SL submissions on:

- May 7, 2017
- May 21, 2017
 - Treated with Slice June 2017 according to AAR tracking spreadsheet, compliance tracking spreadsheet for SL notes Slice treatment began June 2nd 2017.
- Sept 20, 2017
 - Treated with Slice Sept 2017 according to AAR tracking spreadsheet only
 - Treated with Slice Oct 2017 according to AAR tracking spreadsheet, compliance tracking spreadsheet for SL notes Slice treatment began Oct 17th 2017.
- Nov 5, 2017
- Nov 19, 2017
- Dec 3, 2017
- Dec 17, 2017
- Jan 2, 2018
- Jan 19, 2018
- Jan 24, 2018
- Feb 1, 2018
- Feb 6, 2018
- Feb 17, 2018
 - Inventory Spreadsheet indicates Ross started harvesting in Feb 2018
- Feb 27, 2018 (Motiles **Avg = 22.52 going into outmigration period**)
- Mar 4, 2018 (Failure to notify, Avg=13.17) Compliance tracking notes (from monthly SL reporting I assume) that the mitigative action taken is: Harvest
- Mar 20, 2018 (Avg increased to 17.11) Compliance tracking notes (from monthly SL reporting I assume) that the mitigative action taken is: Harvest
 - Inventory spreadsheet predicts Ross was scheduled to be empty in April 2018 (not confirmed)

Please let me know if I can help with anything else.

Cheers,

Michelle Charbonneau MSc.

Aquatic Science Biologist / Biologiste en sciences aquatiques

Fisheries and Oceans Canada / Pêches et Océans Canada

Aquaculture Environmental Operations / Opérations environnementales de l'aquaculture

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Government of Canada | Gouvernement du Canada



Government
of Canada

Gouvernement
du Canada

Canada

Manchester, Howie

From: Waddington, Zac
Sent: May-09-18 2:52 PM
To: Paylor, Adrienne; Keith, Ian; Manchester, Howie; Sandberg, Krista
Subject: RE: sea lice lines

Looks good to me Adrienne. The one thing you could add is that the "neutralized substance" is in fact water and oxygen.

Zac

From: Paylor, Adrienne
Sent: May-09-18 2:17 PM
To: Waddington, Zac; Keith, Ian; Manchester, Howie; Sandberg, Krista
Subject: FW: sea lice lines

Communications just sent me the final and approved media lines for Clayoquot. In speaking with C&P what we are doing right now is gathering information to "assess" if a violation has occurred. [REDACTED]

[REDACTED] I think our letter is idea is fine but I want to get C&P (Greg Plummer) to review it in the morning before we send it out. See new language below that removed the word "investigation" for future use.

Thanks,
Adrienne

From: Rainer, Michelle
Sent: Wednesday, May 09, 2018 1:48 PM
To: Paylor, Adrienne
Subject: sea lice lines

s.21(1)(a)

s.21(1)(b)

DFO is aware of the sea lice exceedances at Cermaq Canada's facilities in Clayoquot and has been in ongoing discussions with the company since January 2018 about measures to reduce sea lice levels.

Under the Pacific Aquaculture Regulations, DFO requires salmon farming companies to regularly monitor and manage sea lice levels at their facilities in BC. DFO also regularly conducts assessments of sea lice abundance at these facilities. Companies in BC must submit a lice reduction plan if monitoring shows sea lice levels higher than three motile sea lice per farmed fish during the wild salmon outmigration period from March 1 to June 30 of each year. Motile lice are those at the free-moving stages of their life cycle.

Salmon farming companies use an in-feed therapeutant called SLICE (emamectin benzoate) to reduce lice abundance. In cases where the use of SLICE does not result in adequate reduction of sea lice, companies can apply to the province of British Columbia for a permit to use alternative treatments, including Paramove (a hydrogen peroxide bath). Please contact Cermaq or the Province of BC's Ministry of Agriculture for further information on this process.

Hydrogen peroxide is widely used around the world, including elsewhere on Canada's west coast, with excellent effect and no demonstrable effects to the ecosystem. This pesticide is not absorbed by the fish and is non-toxic to humans. It also dissipates as a neutralized substance quickly in the environment and causes no discernible far-field effect.

DFO is looking into the management of lice at farms in Clayoquot by Cermaq Canada to determine if there has been non-compliance with the licence conditions and cannot comment further at this time.

DFO makes reports on the numbers of sea lice at BC aquaculture farms available to the public at www.dfo-mpo.gc.ca/aquaculture/protect-protege/parasites-eng.html.

Waddington, Zac

From: Diamond, Maria
Sent: May-09-18 3:05 PM
To: Waddington, Zac
Subject: RE: Characterizing SL over threshold and Treatments for Bawden, Dixon, Millar and Ross

Have you got a minute to have a look at what I have?

From: Waddington, Zac
Sent: May-09-18 2:07 PM
To: Diamond, Maria; Keith, Ian
Cc: Charbonneau, Michelle
Subject: FW: Characterizing SL over threshold and Treatments for Bawden, Dixon, Millar and Ross

Michelle has identified a few farms in Clayoquot who based on the compliance tracking sheet seem not to have met licence conditions of reporting within 7 days of discovering a farm being over threshold. Can you confirm that this is the case and that we weren't notified through any other channels? If we do not have notifications, then I will look into issuing non-compliance letters.

Zac

From: Charbonneau, Michelle
Sent: May-09-18 1:29 PM
To: Waddington, Zac
Cc: Manchester, Howie
Subject: RE: Characterizing SL over threshold and Treatments for Bawden, Dixon, Millar and Ross

Hey Zac, I was mistaken about the Slice treatment Feb 2018 at Ross. That did not happen. Sorry, my bad.

I would love to include when they applied for H2O2, and when that was delayed due to public pressure, in the chronology 😊

I revised this:

Bawden

Fish were entered in April 2017.

An exceedance of three motiles was noted in the monthly SL submissions on:

- May 20, 2017 (Failure to notify)
 - Treated with Slice June 2017 according to AAR Tracking Spreadsheet
- Dec 20, 2017
- Jan 4, 2018
- Jan 18, 2018
 - Treated with Slice Feb 1, 2018 according to Compliance tracking sheet for SL (FHE tab notes all pens treated), confirmed in AAR
- March 6, 2018 (Failure to notify, Avg = 7.98) Compliance tracking notes (from monthly SL reporting I assume) that the mitigative action taken is: Treatment Pending
- March 18, 2018 (Avg increased to 9.83) Compliance tracking notes (from monthly SL reporting I assume) that the mitigative action taken is: Treatment Pending

- March 28, 2018 (Avg further increased to 11.5) Compliance tracking notes (from monthly SL reporting I assume) that the mitigative action taken is: Treatment Pending
 - No treatment noted in March
 - April monthly SL not yet submitted.
 - Inventory spreadsheet suggests no harvesting undertaken or even planned yet.

Dixon

Fish were entered in August 2016

An exceedance of three motiles was noted in the monthly SL submissions on:

- Sept 17, 2017
 - Treated with Slice Sept 2017 according to AAR tracking spreadsheet
- Oct 4, 2017
 - Treated with Slice Oct 2017 according to AAR tracking spreadsheet, compliance tracking spreadsheet for SL notes Slice treatment began Oct 5th 2017.
- Nov 19, 2017
- Dec 19, 2017
 - Inventory spreadsheet indicates Dixon began harvesting in Jan 2018
- Feb 21, 2018 (Motiles **Avg = 4.31 going into outmigration period**)
 - Inventory spreadsheet indicates Dixon has [REDACTED] fish still onsite in March.
- Mar 08, 2018 (Failure to notify, Avg=9.42) Compliance tracking notes (from monthly SL reporting I assume) that the mitigative action taken is: Harvest
- Mar 20, 2018 (Slight reduction in Avg = 8.74) Compliance tracking notes (from monthly SL reporting I assume) that the mitigative action taken is: Harvest
 - Inventory spreadsheet predicts Dixon will be empty in June 2018
 - We are scheduled to audit Dixon May 28th.

Millar

s.20(1)(b)

Fish were entered in March 2017

An exceedance of three motiles was noted in the monthly SL submissions on:

- May 4, 2017
- May 20, 2017
 - Treated with Slice June 2017 according to AAR tracking spreadsheet, compliance tracking spreadsheet for SL notes Slice treatment began June 2nd 2017.
- August 20, 2017
- Sept 5, 2017
- Sept 18, 2017
 - Treated with Slice Sept 2017 according to AAR tracking spreadsheet, compliance tracking spreadsheet for SL notes Slice treatment began Sept 29th 2017.
- Oct 20, 2017
- Nov 3, 2017
- Nov 19, 2017
- Dec 4, 2017
- Jan 3, 2018
- Jan 19, 2018
- Jan 24, 2018
- Feb 1, 2018
- Feb 6, 2018
- Feb 17, 2018 (Motiles **Avg = 14.73 going into outmigration period**)
 - Inventory Spreadsheet indicates Millar started harvesting in Feb 2018

- Mar 4, 2018 (Failure to notify, Avg=20.97) Compliance tracking notes (from monthly SL reporting I assume) that the mitigative action taken is: Harvest
- Mar 18, 2018 (Avg = 19.59) Compliance tracking notes (from monthly SL reporting I assume) that the mitigative action taken is: Harvest
- Mar 30, 2018 (Avg = 30.10) Compliance tracking notes (from monthly SL reporting I assume) that the mitigative action taken is: Harvest
 - Inventory spreadsheet predicts Millar was scheduled to be empty in April 2018 (not confirmed)
 - Inventory spreadsheet predicts Millar will want to restock [REDACTED]

Ross

Fish were entered in September 2016

An exceedance of three motiles was noted in the monthly SL submissions on:

- May 7, 2017
- May 21, 2017
 - Treated with Slice June 2017 according to AAR tracking spreadsheet, compliance tracking spreadsheet for SL notes Slice treatment began June 2nd 2017.
- Sept 20, 2017
 - Treated with Slice Sept 2017 according to AAR tracking spreadsheet only
 - Treated with Slice Oct 2017 according to AAR tracking spreadsheet, compliance tracking spreadsheet for SL notes Slice treatment began Oct 17th 2017.
- Nov 5, 2017
- Nov 19, 2017
- Dec 3, 2017
- Dec 17, 2017
- Jan 2, 2018
- Jan 19, 2018
- Jan 24, 2018
- Feb 1, 2018
- Feb 6, 2018
- Feb 17, 2018
 - Inventory Spreadsheet indicates Ross started harvesting in Feb 2018
- Feb 27, 2018 (Motiles **Avg = 22.52 going into outmigration period**)
- Mar 4, 2018 (Failure to notify, Avg=13.17) Compliance tracking notes (from monthly SL reporting I assume) that the mitigative action taken is: Harvest
- Mar 20, 2018 (Avg increased to 17.11) Compliance tracking notes (from monthly SL reporting I assume) that the mitigative action taken is: Harvest
 - Inventory spreadsheet predicts Ross was scheduled to be empty in April 2018 (not confirmed)

Please let me know if I can help with anything else.

Cheers,

s.20(1)(b)

Michelle Charbonneau MSc.

Aquatic Science Biologist / Biologiste en sciences aquatiques

Fisheries and Oceans Canada / Pêches et Océans Canada

Aquaculture Environmental Operations / Opérations environnementales de l'aquaculture

Fisheries Management / Gestion des pêches

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du Canada

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No information has been removed or severed from this page

Manchester, Howie

From: Keith, Ian
Sent: May-09-18 6:36 PM
To: Paylor, Adrienne; Waddington, Zac; Sandberg, Krista; Manchester, Howie
Subject: RE: sea lice lines
Attachments: DFO is aware of the sea lice exceedances at Cermaq Canada_ik2.docx

I didn't send you the right copy – I'm sorry.

Please see the version which reads better and includes Jon's suggestion that PMRA registration and the need for permitting is included.

Ian

From: Paylor, Adrienne
Sent: May-09-18 4:09 PM
To: Waddington, Zac; Keith, Ian; Sandberg, Krista; Manchester, Howie
Subject: RE: sea lice lines

Great I gave them to Michelle Rainer and she has updated.

Thx A

From: Waddington, Zac
Sent: Wednesday, May 09, 2018 3:54 PM
To: Keith, Ian; Sandberg, Krista; Manchester, Howie; Paylor, Adrienne
Subject: RE: sea lice lines

I agree with Ian's edits wholeheartedly. I should have picked up on that during my read, since Integrated Pest Management is about rotating tools before you see resistance, not merely in response to resistance.

Zac

From: Keith, Ian
Sent: May-09-18 3:31 PM
To: Waddington, Zac; Sandberg, Krista; Manchester, Howie
Cc: Paylor, Adrienne
Subject: FW: sea lice lines

This is how I would write the paragraph I have problems with, and think that our first conversations in November is the correct date to use.

From: Keith, Ian
Sent: May-09-18 3:00 PM
To: Paylor, Adrienne
Subject: RE: sea lice lines

Hi Adrienne,

I just called Jon Chamberlain to confirm that it is Ministry of Environment, and attached please find my straight talk i.e. good practice rather than saying Integrated Pest Management.

From: Paylor, Adrienne
Sent: May-09-18 2:17 PM

s.19(1)

To: Waddington, Zac; Keith, Ian; Manchester, Howie; Sandberg, Krista
Subject: FW: sea lice lines

Communications just sent me the final and approved media lines for Clayoquot. In speaking with C&P what we are doing right now is gathering information to "assess" if a violation has occurred. [REDACTED] I think our letter is idea is fine but I want to get C&P (Greg Plummer) to review it in the morning before we send it out. See new language below that removed the word "investigation" for future use.

Thanks,
Adrienne

From: Rainer, Michelle
Sent: Wednesday, May 09, 2018 1:48 PM
To: Paylor, Adrienne
Subject: sea lice lines

DFO is aware of the sea lice exceedances at Cermaq Canada's facilities in Clayoquot and has been in ongoing discussions with the company since January 2018 about measures to reduce sea lice levels.

Under the Pacific Aquaculture Regulations, DFO requires salmon farming companies to regularly monitor and manage sea lice levels at their facilities in BC. DFO also regularly conducts assessments of sea lice abundance at these facilities. Companies in BC must submit a lice reduction plan if monitoring shows sea lice levels higher than three motile sea lice per farmed fish during the wild salmon outmigration period from March 1 to June 30 of each year. Motile lice are those at the free-moving stages of their life cycle.

Salmon farming companies use an in-feed therapeutant called SLICE (emamectin benzoate) to reduce lice abundance. In cases where the use of SLICE does not result in adequate reduction of sea lice, companies can apply to the province of British Columbia for a permit to use alternative treatments, including Paramove (a hydrogen peroxide bath). Please contact Cermaq or the Province of BC's Ministry of Agriculture for further information on this process.

Hydrogen peroxide is widely used around the world, including elsewhere on Canada's west coast, with excellent effect and no demonstrable effects to the ecosystem. This pesticide is not absorbed by the fish and is non-toxic to humans. It also dissipates as a neutralized substance quickly in the environment and causes no discernible far-field effect.

DFO is looking into the management of lice at farms in Clayoquot by Cermaq Canada to determine if there has been non-compliance with the licence conditions and cannot comment further at this time.

DFO makes reports on the numbers of sea lice at BC aquaculture farms available to the public at www.dfo-mpo.gc.ca/aquaculture/protect-protege/parasites-eng.html.

s.21(1)(a)

s.21(1)(b)

DFO is aware of the sea lice exceedances at Cermaq Canada's facilities in Clayoquot and has been in ongoing discussions with the company since November 2017~~January 2018~~ about measures to reduce sea lice levels.

Under the Pacific Aquaculture Regulations, DFO requires salmon farming companies to regularly monitor and manage sea lice levels at their facilities in BC. DFO also regularly conducts assessments of sea lice abundance at these facilities. Companies in BC must submit and follow a lice reduction plan if monitoring shows sea lice levels higher than three motile sea lice per farmed fish during the wild salmon outmigration period from March 1 to June 30 of each year. Motile lice are those at the free-moving stages of their life cycle.

Salmon farming companies use an in-feed therapeutant called SLICE (emamectin benzoate) to reduce lice abundance. As part of good practice, companies will ~~In cases where the use of SLICE does not result in adequate reduction of sea lice, companies can apply to the province of British Columbia for a permit to use alternative treatments, including Paramove (a hydrogen peroxide bath). The product is registered for sea lice management in aquaculture by the pest management arm of Health Canada, and companies must apply for a permit use the product on a farm.~~ Please contact Cermaq or the Province of BC's Ministry of EnvironmentAgriculture for further information on this process.

Hydrogen peroxide is widely used around the world, including elsewhere on Canada's west coast, with excellent effect and no demonstrable effects to the ecosystem. This pesticide is not absorbed by the fish and is non-toxic to humans. It also dissipates as a neutralized substance quickly in the environment and causes no discernible far-field effect.

DFO is looking into the management of lice at farms in Clayoquot by Cermaq Canada to determine if there has been non-compliance with the licence conditions and cannot comment further at this time.

DFO makes reports on the numbers of sea lice at BC aquaculture farms available to the public at www.dfo-mpo.gc.ca/aquaculture/protect-protege/parasites-eng.html.

Waddington, Zac

From: Waddington, Zac
Sent: May-10-18 1:06 PM
To: Keith, Ian
Subject: FW: Clayoquot Lice Management

From: Paylor, Adrienne
Sent: May-10-18 12:56 PM
To: Waddington, Zac
Subject: RE: Clayoquot Lice Management

Ok I just spoke to Allison....I will call shortly

DFO veterinarians have been monitoring the management of lice in Clayoquot, and have been in discussions with fish health and veterinary staff at Cermaq regarding plans for lice management. These plans have changed throughout early 2018 as a result of ongoing delays with attaining a Pesticide Use Permit for peroxide use in Clayoquot. While we appreciate this challenge, we have some questions to clarify what options have been pursued and exhausted by Cermaq that justify the current state of lice burden on numerous farms in Clayoquot. Specifically:

- Area-based SLICE treatment in late September to early October in Clayoquot had reduced efficacy and duration of effect than what is expected at numerous sites. Please demonstrate how appropriate therapeutic SLICE use was ensured as per Merck's Slice Sustainability Project.
- How were other treatment measures considered such as increased processing capacity at other facilities, use of Marine Harvest Canada's Hydrolizer, an earlier start to harvest at affected farms, and any other options considered?
- What, if any, monitoring of smolt lice burden has Cermaq conducted to monitor for effects on wild salmon smolts?
- Based on our lice data currently available to us up to the end of March, it appears that Bawden, Dixon Bay, Millar Channel, Ross Pass and Saranac Island did not have a reduction in "absolute sea lice inventory" as per licence condition 6.4(a).

Please provide any information and/or documents to address the questions or that will assist in our assessment of compliance regarding this issue. I look forward to hearing from you by May 18, 2018. If you have any questions or required further clarification please do not hesitate to contact me at....

From: Waddington, Zac
Sent: Thursday, May 10, 2018 10:51 AM
To: Paylor, Adrienne; Keith, Ian; Manchester, Howie; Sandberg, Krista; Keith, Ian
Subject: RE: Clayoquot Lice Management

I will give you a shout right away. Please see the attached draft which highlights the farms that were over threshold in March, and had an upward trend in sea lice numbers during March. When sea lice numbers are submitted next week, we will be able to update these graphs further to include April. Thanks Krista!

Zac

From: Paylor, Adrienne
Sent: May-10-18 8:42 AM
To: Waddington, Zac; Keith, Ian; Manchester, Howie
Subject: RE: Clayoquot Lice Management

Hi Zac,

I have reviewed that letter with C&P and only had the attached changes. I know you guys were still working on it so when you have it all together we should provide an updated copy to Allison. She want me to call her for some more background but we haven't connected yet. I'm in meetings as of 9am so maybe you could arrange a short chat with her before the letter goes out.

Thx Adrienne

From: Waddington, Zac
Sent: Wednesday, May 09, 2018 2:11 PM
To: Paylor, Adrienne; Keith, Ian; Manchester, Howie
Subject: Clayoquot Lice Management

We have been monitoring the management of lice in Clayoquot, and have been in discussion with fish health and veterinary staff at Cermaq regarding plans for lice management. These plans have changed throughout early 2018 as a result of ongoing delays with attaining a Pesticide Use Permit for Clayoquot. While we are sympathetic to this challenge, we have some questions to clarify what due diligence and mitigation options have been pursued and exhausted by Cermaq that justify the current state of lice burden on numerous farms in Clayoquot. Specifically:

- Area-based SLICE treatment in late September to early October in Clayoquot had reduced efficacy and duration of effect than is expected at numerous sites. Please demonstrate how appropriate therapeutic SLICE use was ensured as per Merck's Slice Sustainability Project
- How were other treatment measures considered such as fresh water baths, increased processing capacity at other facilities, use of Marine Harvest Canada's Hydrolicer, earlier start to harvest at most affected farms?

Dr. Zac Waddington DVM, B.Env.Sc.(Hons)
Lead Veterinarian - Pacific Region
Fisheries and Oceans Canada | Pêches et Océans Canada
Aquaculture Environmental Operations - Fish Health
Courtenay, British Columbia
Telephone | Téléphone: 250-703-0902
Fax | Télécopieur: 250-703-0921
Zac.Waddington@dfo-mpo.gc.ca

Bate, Dan

From: Bate, Dan
Sent: May-11-18 12:22 PM
To: Petersen, Krista
Subject: RE: RE: Radio-Canada request: Demande d'information - Poux du saumon - Colombie-Britannique

Sorry no.. we don't.

From: Petersen, Krista
Sent: May-11-18 12:21 PM
To: Bate, Dan
Subject: RE: RE: Radio-Canada request: Demande d'information - Poux du saumon - Colombie-Britannique

Do you have the lines in French?

De : Bate, Dan
Envoyé : 2018-May-11 4:18 PM
À : [REDACTED]
Cc : Petersen, Krista; Girouard, Louise; Rainer, Michelle
Objet : RE: Radio-Canada request: Demande d'information - Poux du saumon - Colombie-Britannique

Bonjour madam, [REDACTED]

J'ai bien compris nos collègues de Moncton que vous recherchez des informations concernant les poux dans les élevages piscicoles à Clayoquot Sound, en Colombie-Britannique. Malheureusement il n'y a aucun communiqué de presse, mais je suis heureux de partager les informations suivantes avec vous.

Merci,
Dan

- DFO is aware of the sea lice exceedances at Cermaq Canada's facilities in Clayoquot and has been in ongoing discussions with the company since January 2018 about measures to reduce sea lice levels.
- Under the Pacific Aquaculture Regulations, DFO requires salmon farming companies to regularly monitor and manage sea lice levels at their facilities in BC. DFO also regularly conducts assessments of sea lice abundance at these facilities. Companies in BC must submit a lice reduction plan if monitoring shows sea lice levels higher than three motile sea lice per farmed fish during the wild salmon outmigration period from March 1 to June 30 of each year. Motile lice are those at the free-moving stages of their life cycle.
- Salmon farming companies use an in-feed therapeutant called SLICE (emamectin benzoate) to reduce lice abundance. In cases where the use of SLICE does not result in adequate reduction of sea lice, companies can apply to the province of British Columbia for a permit to use alternative treatments, including Paramove (a hydrogen peroxide bath). Please contact Cermaq or the Province of BC's Ministry of Agriculture for further information on this process.
- Hydrogen peroxide is widely used around the world, including elsewhere on Canada's west coast, with excellent effect and no demonstrable effects to the ecosystem. This pesticide is not absorbed by the fish and is non-toxic to humans. It also dissipates as a neutralized substance quickly in the environment and causes no discernible far-field effect.

s.19(1)

- DFO is looking into the management of lice at farms in Clayoquot by Cermaq Canada to determine if there has been non-compliance with the licence conditions and cannot comment further at this time.
- DFO makes reports on the numbers of sea lice at BC aquaculture farms available to the public at www.dfo-mpo.gc.ca/aquaculture/protect-protege/parasites-eng.html.

Dan Bate

Team Lead, Communications

Fisheries and Oceans Canada Pacific Region / Canadian Coast Guard / Government of Canada

Dan.Bate@dfo-mpo.gc.ca / Tel: (604) 775-8809 / Cell: [REDACTED]

Chef d'équipe, communications

Pêches et Océans Canada, région du Pacifique / Garde côtière canadienne / Gouvernement du Canada

Dan.Bate@dfo-mpo.gc.ca / Tél : (604) 775-8809 / Tél. cell. : [REDACTED]

s.16(2)(c)

See attached motile lice levels by site, sea lice load by site, and total lice load combined for the 3 farms in question. May is estimated based on harvest plan and continued lice level increases of 2.5 motile lice / fish per week for those fish remaining despite recent decrease in lice level at Dixon due to salinity (ie the estimate is conservative).

Please demonstrate how appropriate therapeutic SLICE use was ensured as per Merck's Slice Sustainability Project.

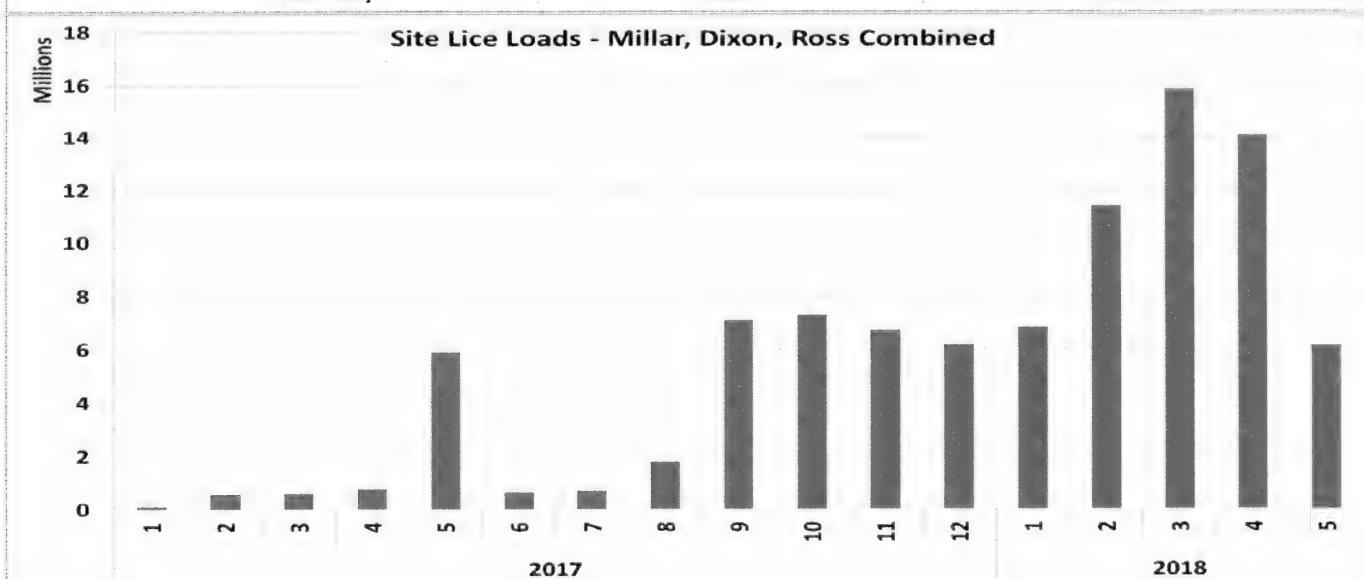
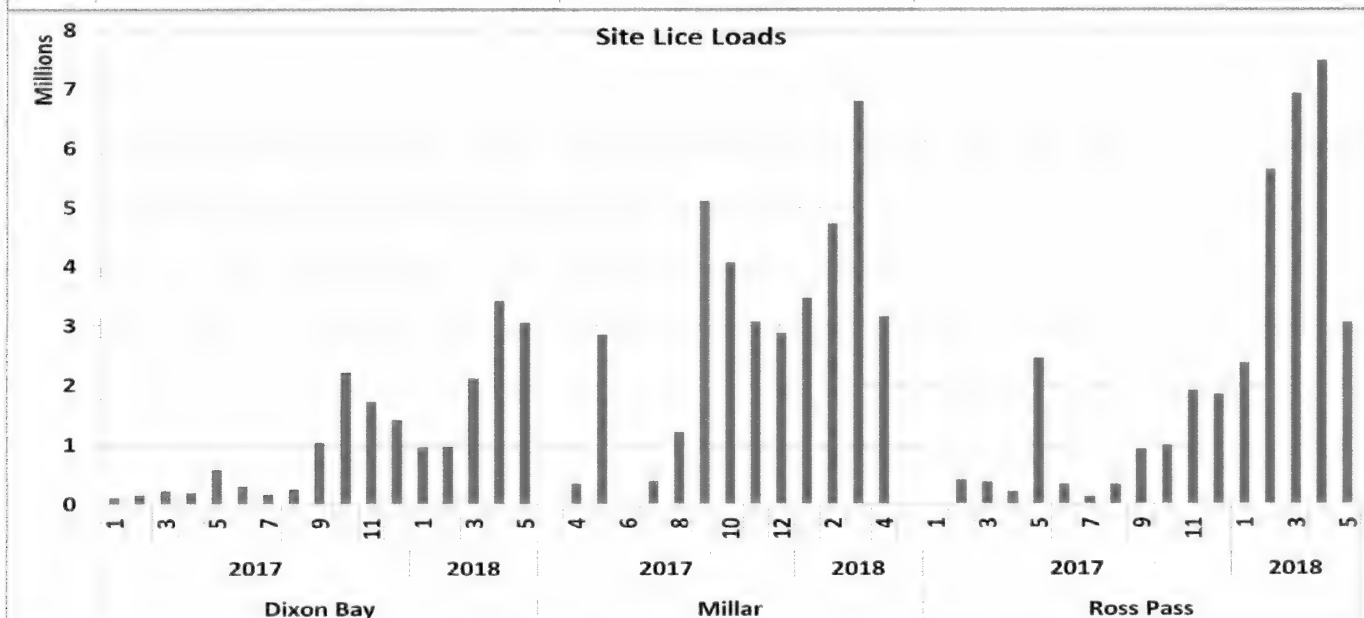
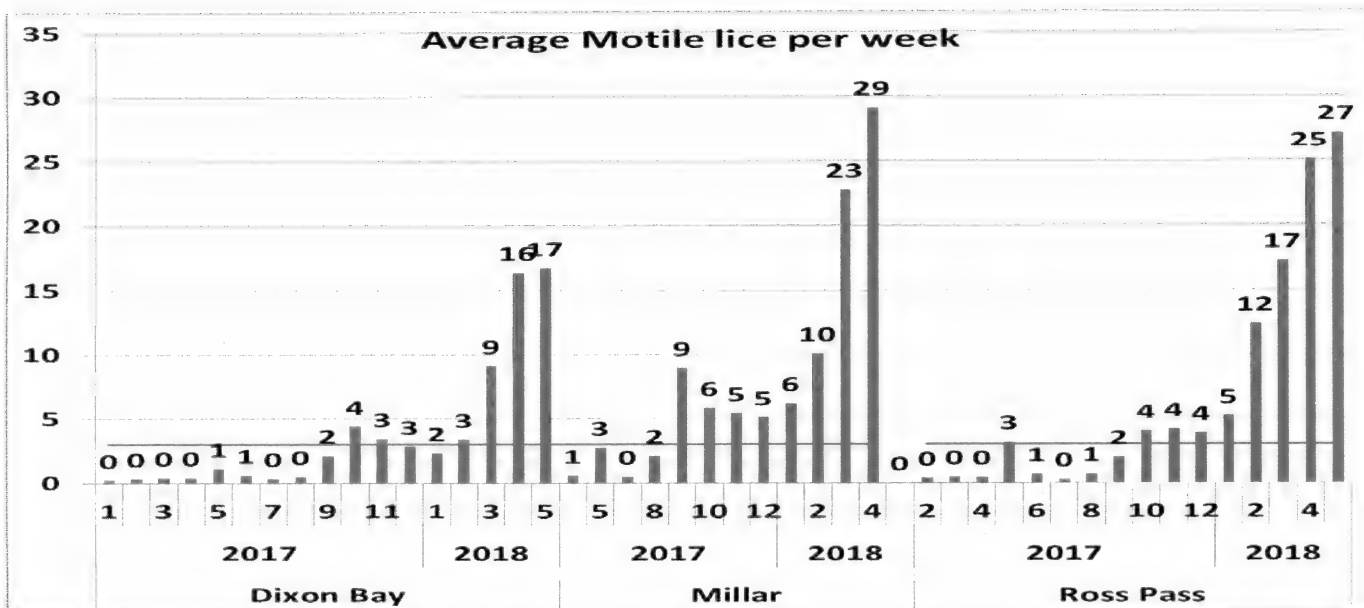
- 1) See attached. Of the 6 most recent treatments 5 would be considered very good with only one (Millar June) suboptimal. More recent treatments (October) have been slightly altered with regards to targeted dosage to compensate for the EB incorporation historical rates in feed at the farm.

How were other treatment measures considered such as increased processing capacity at other facilities, use of Marine Harvest Canada's Hydrolicer, an earlier start to harvest at affected farms, and any other options considered?

- 2) Harvesting started at Dixon January 14th. Scheduled harvesting was originally planned for February 20th. Prior to the 14th the processing plant in Tofino was undergoing plant upgrades including effluent treatment improvements. Alternative harvesting / processing was considered but not chosen for several reasons. Harvesting and sending vessels around the island at that time of year is generally not recommended due to safety concerns and expected weather delays. Harvesting and moving fish across the island was not recommended due to lack of staff and logistics (totes or tankers and pumping stations) to develop that capacity in a safe manner given staffing was a limiting factor to manage anticipated facility upgrades and maximum plant capacity as is. If staffing and logistics could have been worked out Brown's Bay was also anticipating being at full capacity as of February and was not a long term viable option. As it turns out Brown's Bay has been at full capacity since mid-February.
- 3) As of February Marine Harvest Canada's Hydrolicer was not available for use. Note that this hydrolicer has not been used as of May 2018 due to design flaws that impact the welfare of the treated fish in jeopardy. The hydrolicer currently being built for Cermaq Canada has been designed as purpose built with updated modifications to ensure optimal efficiency and improved welfare.
- 4) Salinity has a significant impact on lice levels (see graph for recent history). During the fall of 2017 freshwater was also trialed and considered. In situ freshwater was trialed at Fortune Channel. Although technically feasible to reduce salinity using desalination it was not practical due to technical limitations on scaling up the project to a full site (desalination equipment for just one cage was expensive, difficult to run, difficult to keep running full time due to fuel, and routinely down due to constant exchange of filters).

What, if any, monitoring of smolt lice burden has Cermaq conducted to monitor for effects on wild salmon smolts?

- 5) Cermaq has historically been involved in several wild smolt monitoring projects in Clayoquot but in 2016 implemented a standardized wild smolt monitoring program along with other industry partners to ensure independent data collection and reporting was occurring in a standardized way. Decisions regarding number of sites, sampling method, and timing corresponds to previous DFO investigations including those in the Broughton and Nootka Sound. This most recent program involves three sampling events in April and May involving 17 sites. See attachments for 2016 and 2017 summaries. Results are made public on the Cermaq website with a target of being made public within 8 weeks of data collection. These results have also been included in the MERP / BCSFA initiative involving Dr. Crawford Revie.
- 6) An additional sampling period (late May) has been added to the 2018 sampling period given the current circumstances. Despite the additional sampling we intend to have results made public within the original time period (before the end of June).
- 7) The dominant wild smolt species by far is the chum salmon. As with other areas we'll expect large annual variations dependent upon factors such as migration routes and timing, salinity, and wild returns. We plan on involving an external expert to review the Clayoquot data (Dr. Revie) much the same as has been done with the Broughton and Nootka data.



Flesh - Poor = < 80% of target average plus more than 3 < 50% of target; Acceptable = > 80 % average above target plus no more than 1 < 50% of target; Good = > 80 average above target plus all fish > 80 % of target

Feed - Poor = < 80%; Acceptable - 80 - 90%; Good > 90%

Site	Month	sample	Feed		Flesh	
			Average of EB	Average of Target	Average of EB	Average of Target
Dixon	6	1	4.9	5.0	67.6	60.0
		2			55.5	60.0
		3			79.6	60.0
		4			65.2	60.0
		5			58.7	60.0
	10	1	7.8	9.1	69.5	60.0
		2			63.4	60.0
		3			50.9	60.0
		4			34.5	60.0
		5			61.5	60.0
Ross	6	1	4.6	5.0	45.0	60.0
		2			67.0	60.0
		3			47.9	60.0
		4			56.1	60.0
		5			58.3	60.0
	10	1	7.3	7.7	85.7	60.0
		2			92.3	60.0
		3			54.4	60.0
		4			82.4	60.0
		5			75.2	60.0
Millar	6	1			39.0	60.0
		2			53.2	60.0
		3			24.1	60.0
		4			35.6	60.0
		5			53.7	60.0
	10	1	5.0	6.3	69.5	60.0
		2			63.4	60.0
		3			58.6	60.0
		4			48.3	60.0
		5			69.3	60.0

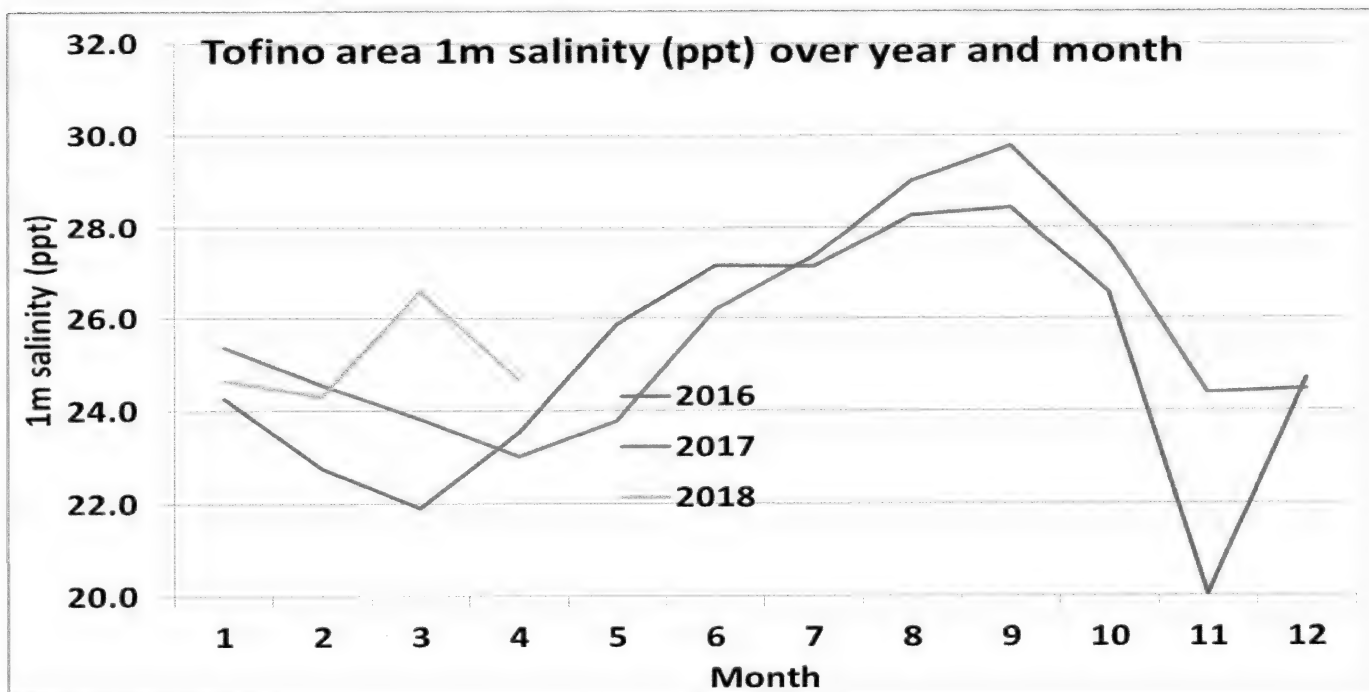


Table 5: Calculated sea lice prevalence and abundance by site as determined for chum salmon collected in Clayoquot Sound, BC in 2016.

Site	# of Chum Analyzed	# of Infected Chum	# of Lice	Sea Lice Prevalence	Sea Lice Abundance
SL1	90	57	120	63.3%	1.33
SL2	61	27	80	44.3%	1.31
SL3	32	0	0	0	0
MC1	63	12	13	19.0%	0.21
MC3	20	5	9	25.0%	0.45
HI1	42	4	5	9.5%	0.12
HI2	15	0	0	0	0
BS1	56	44	110	78.6%	1.96
BS2	90	50	125	55.6%	1.39
BS3	15	3	10	20.0%	0.67
BS4	79	39	94	49.4%	1.19
BS5	90	6	10	6.7%	0.11
BS6	64	33	97	51.6%	1.52
FC2	0	0	0	-	-
FC3	35	15	19	42.9%	0.54
FC4	61	5	5	8.2%	0.08
FC5	23	14	29	60.9%	1.26
TOTAL	836	314	726	37.6%	0.87

Table 4: Results of analysis for sea lice infestation on the sample population collected by beach seine in Clayoquot Sound, BC in 2017.

Species	Sample size (n)	Total number of lice observed	Total number of fish infested	Prevalence (%)	Abundance	Average Intensity
chum	1122	354	222	19.8	0.32	1.6
coho	84	21	8	9.5	0.25	2.6
sockeye	38	6	4	10.5	0.16	1.5
threespine stickleback	1	0	0	0	0	0
Total	1245	381	234	18.8	0.31	1.6

Waddington, Zac

From: Rainer, Michelle
Sent: May-14-18 10:43 AM
To: Waddington, Zac
Cc: Paylor, Adrienne
Subject: Cermaq lice

Hi Zac,
Allison thought you might have some updates on this that we could offer the reporter today. Do you have a few minutes to help with this?
Thanks,
Michelle

From: [REDACTED]
Sent: May-14-18 10:38 AM
To: Rainer, Michelle
Subject: Re: DFO response

Hi Michelle,

Is there any update on this investigation? I'm filing another story for tomorrow morning about Cermaq Canada voluntarily withdrawing its ASC certification on its fish until the sea lice is under control. I will include the latest info, if there's an update.

Thanks,

[REDACTED]
CBC Victoria
Phone: [REDACTED]
Cell: [REDACTED]

On Mon, May 7, 2018 at 10:18 AM, Rainer, Michelle <Michelle.Rainer@dfo-mpo.gc.ca> wrote:

Hi [REDACTED]

Regarding your inquiry Friday about sea lice:

DFO is aware of the sea lice exceedances at Cermaq Canada's facilities in Clayoquot and has been in ongoing discussions with the company since January 2018 about measures to reduce sea lice levels.

Under the Pacific Aquaculture Regulations, DFO requires salmon farming companies to regularly monitor and manage sea lice levels at their facilities in BC. DFO also regularly conducts assessments of sea lice abundance at these facilities.

Companies in BC must submit a lice reduction plan if monitoring shows sea lice levels higher than three motile sea lice per farmed fish during the wild salmon outmigration period from March 1 to June 30 of each year. Motile lice are those at the free-moving stages of their life cycle.

Salmon farming companies use an in-feed therapeutant called SLICE (emamectin benzoate) to reduce lice abundance. In cases where the use of SLICE does not result in adequate reduction of sea lice, companies can apply to the province of British Columbia for a permit to use alternative treatments, including Paramove (a hydrogen peroxide bath). Please contact Cermaq or the Province of BC's Ministry of Agriculture for further information on this process.

Hydrogen peroxide is widely used around the world, including elsewhere on Canada's west coast, with excellent effect and no demonstrable effects to the ecosystem. This pesticide is not absorbed by the fish and is non-toxic to humans. It also dissipates as a neutralized substance quickly in the environment and causes no discernible far-field effect.

DFO is investigating the management of lice at farms in Clayoquot by Cermaq Canada to determine if there has been non-compliance with the licence conditions and cannot comment further at this time.

DFO makes reports on the numbers of sea lice at BC aquaculture farms available to the public at www.dfo-mpo.gc.ca/aquaculture/protect-protege/parasites-eng.html.

Kind regards,

Michelle Rainer

Communications Advisor | Conseillère en communications

Fisheries and Oceans Canada | Pêches et Océans Canada

200 - 401 Burrard Street, Vancouver, B.C. V6C 3S4 | 200 - 401 rue Burrard, Vancouver, C.-B. V6C 3S4

Telephone | Téléphone 604-775-5065

Waddington, Zac

From: Rainer, Michelle
Sent: May-14-18 12:59 PM
To: Waddington, Zac
Subject: RE: Clayoquot lice management

OK, thanks Zac I'll leave it out for now.

From: Waddington, Zac
Sent: May-14-18 12:53 PM
To: Rainer, Michelle
Subject: RE: Clayoquot lice management

I have discussed that with Adrienne, and the concern is that we are already well into the outmigration, and our boat and field staff are quite busy already. I have asked Cermaq to notify us if they are undertaking smolt monitoring themselves, and hopefully they are. We did conduct additional monitoring in the summer of 2017 with Grieg, and so we are aware of the lice effects due to unmanaged lice levels. The current plan is not to since we don't believe it will tell us more than we already know, which is that it's an ugly situation which we need to ensure we can prevent in the future. I would love to make mention of us strengthening our conditions of licence around lice management; however, that decision needs to come from higher up.

Zac

From: Rainer, Michelle
Sent: May-14-18 11:58 AM
To: Waddington, Zac
Subject: RE: Clayoquot lice management

Thanks, Zac. Should also have asked, can we add that we will do additional monitoring of wild fish in the area? For a past issue we used this line:

- In addition to the monitoring undertaken by industry, the Department is conducting supplementary monitoring of juvenile wild salmon in the vicinity of these farms.

From: Waddington, Zac
Sent: May-14-18 11:39 AM
To: Rainer, Michelle
Subject: FW: Clayoquot lice management

*****Confidential Not For Distribution*****

Please see below for our letter sent Friday.

s.19(1)

Zac

From: [REDACTED]
Sent: May-13-18 2:47 AM
To: Keith, Ian

Cc: Waddington, Zac
Subject: Re: Clayoquot lice management

Thanks Ian. I will make sure everyone is informed and start on a response no day.

CERMAQ

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Direct +1 250-286-0022 ext
Mobile

Cermaq Canada Ltd.
203 - 919 Island Hwy
V9W 2C2 Campbell River, BC, Canada

Cermaq.ca [Facebook](#) [Twitter](#)

On May 11, 2018, at 4:02 PM, Keith, Ian <Ian.Keith@dfo-mpo.gc.ca> wrote:

Hi

DFO veterinarians have been monitoring the management of lice in Clayoquot, and have been in discussions with fish health and veterinary staff at Cermaq regarding plans for lice management since Fall 2017. These plans changed throughout early 2018, from 1) a January 11 plan to SLICE treat one farm pending favourable bioassay, and immediate harvest in anticipation of the outmigration period for those 3 farms where SLICE treatment was contraindicated ; to 2) a April 30 plan to peroxide-treat farms where there was exceedance during the outmigration period where SLICE treatment is contraindicated, and manage by harvest at the others. Note that the DFO response January 12 to the January 11 plan stated that when using harvest as a management tool in advance of the outmigration period, that harvesting would have to be finished by the end of February.

Millar is the only farm that has been harvested-out, to date, and none of Ross, Dixon, Mussel and Saranac, where the lice management plan is harvest, have met the required outcome of reduction in "absolute sea lice inventory" (as per licence condition 6.4(a)), based on lice data currently available to us (using average month inventory x average abundance).

While we appreciate the challenges, including delays in acquiring a Pesticide Use Permit for peroxide, we require further explanation and evidence that indicate to DFO what options have been pursued and exhausted by Cermaq that justify the current state of lice burden on numerous farms in Clayoquot. Specifically:

- Area-based SLICE treatment in late September to early October at numerous sites in Clayoquot had reduced efficacy and duration of effect than what is expected. Please demonstrate how appropriate therapeutic SLICE use was ensured as per Merck's Slice Sustainability Project.
- How were other treatment measures considered such as increased processing capacity at other facilities, use of Marine Harvest Canada's Hydrolicer, an earlier start to harvest at affected farms, and any other options considered?
- What, if any, monitoring of smolt lice burden has Cermaq conducted to monitor for effects on wild salmon smolts?

s.19(1)

Please provide any information and/or documents to address the questions or that will assist in our assessment of compliance regarding this issue. I look forward to hearing from you by May 18, 2018. If you have any questions or required further clarification please do not hesitate to contact Zac Waddington at 250-703-0902 or Ian Keith at 250-703-0917.

Thanks for your attention concerning this issue.

Regards,
Ian

Dr. Ian Keith DVM
Field Operations Veterinarian – Pacific Region
Fisheries and Oceans Canada | Pêches et Océans Canada
Fisheries Management
Aquaculture Management Division | Gestion de l'aquaculture
Aquaculture Environmental Operations – Fish Health
#103 – 2435 Mansfield Drive
Courtenay, British Columbia V9N 2M2
Telephone | Téléphone: 250-703-0917
Mobile | Portable: [REDACTED]
Fax | Télécopieur: 250-703-0921
Ian.Keith@dfo-mpo.gc.ca

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s.16(2)(c)

Waddington, Zac

From: Waddington, Zac
Sent: May-14-18 1:04 PM
To: Rainer, Michelle
Subject: Re: Cermaq sea lice media request

Looks good to me.

Zac

From: Rainer, Michelle
Sent: Monday, May 14, 2018 12:53 PM
To: Waddington, Zac; Doucette, Claire
Subject: RE: Cermaq sea lice media request

Thanks, Zac. Looks good to me. I suggest for the last bit we say:

- if non-compliance with licence conditions is found to have occurred, then a formal letter of non-compliance will be issued and [REDACTED] enforcement options will be considered.”

Claire, does that look OK to you?

From: Waddington, Zac
Sent: May-14-18 12:50 PM
To: Rainer, Michelle; Doucette, Claire
Subject: RE: Cermaq sea lice media request

My thoughts. I did edit bullet two a bit as well.

- Fisheries and Oceans Canada (DFO) is reviewing Cermaq Canada's sea lice management practices at these farms to determine if relevant licence conditions have been followed appropriately.
- Our fish health veterinarians have requested documentation to determine the appropriateness of treatments undertaken at farms, and to ensure that all other treatment and harvest options were duly considered by Cermaq. Financial considerations would not be recognized as justification for exclusion of otherwise effective lice management options.
- Please note that this is not a formal investigation under the *Fisheries Act* or regulations; however, based on the results of DFO's review, the company may be required to ?????My thoughts would be that “if non-compliance with licence conditions is found to have occurred, then a formal letter of non-compliance will be issued and [REDACTED] will be considered.”

Zac

s.21(1)(b)

From: Rainer, Michelle
Sent: May-14-18 11:56 AM
To: Waddington, Zac; Doucette, Claire

Subject: Cermaq sea lice media request

Importance: High

Hi Zac,

How is this? Can you fill in the blank at the end outlining any measures/changes that may be required of Cermaq?

Claire, can you please review the wording explaining it's not a formal investigation? This reporter previously receive the version that implied it was.

Thanks,
Michelle

Issue: [REDACTED] CBC ([REDACTED]) is doing a follow-up story on the elevated sea lice levels at Cermaq farms in Clayoquot. Cermaq Canada is voluntarily withdrawing its ASC certification on its fish until the sea lice is under control.

Deadline: May 14, 4 p.m. PST

Recommendation: email lines

Approved by:

Media lines:

- Fisheries and Oceans Canada (DFO) is reviewing Cermaq Canada's sea lice management practices at these farms to determine if relevant licence conditions have been followed appropriately.
- Our fish health veterinarians have requested records documenting the treatment options Cermaq used or considered and to assess whether therapeutants were used appropriately. Financial considerations would not be recognized as justification for exclusion of otherwise effective lice management options.
- Please note that this is not a formal investigation under the *Fisheries Act* or regulations; however, based the results of DFO's review, the company may be required to ?????

s.19(1)

Waddington, Zac

From: Webb, Allison
Sent: May-14-18 3:33 PM
To: Paylor, Adrienne; Waddington, Zac
Subject: FW: For approval: media lines on sea lice

Importance: High

FYI approved.

Allison Webb, Director / Directrice
Aquaculture Management / Gestion de l'aquaculture
Fisheries Management Branch / Direction de la gestion des pêches
Fisheries and Oceans Canada / Pêches et Océans Canada
200 - 401 Burrard St / Rue Burrard, Vancouver BC / C.B. V6C 3S4 Canada
604-666-7009
Allison.webb@dfo-mpo.gc.ca

From: Imbeau, Michelle
Sent: 2018-May-14 2:52 PM
To: Webb, Allison
Cc: Rainer, Michelle
Subject: FW: For approval: media lines on sea lice
Importance: High

Allison: for your approval please.

Issue: [REDACTED] CBC ([REDACTED]) is doing a follow-up story on the elevated sea lice levels at Cermaq farms in Clayoquot. Cermaq Canada is voluntarily withdrawing its ASC certification on its fish until the sea lice is under control.

Deadline: May 14, 4 p.m. PST

Recommendation: email lines

Approved by: Zac Waddington, Claire Doucette

Media lines:

- Fisheries and Oceans Canada (DFO) is reviewing Cermaq Canada's sea lice management practices at these farms to determine if relevant licence conditions have been followed appropriately.
- Our fish health veterinarians have requested documentation to determine the appropriateness of treatments undertaken at farms, and to ensure that all other treatment and harvest options were duly considered by Cermaq. Financial considerations would not be recognized as justification for exclusion of otherwise effective lice management options.
- Please note that this is not a formal investigation under the *Fisheries Act* or regulations; however, if there has been non-compliance with the licence conditions, DFO will address the matter with an appropriate enforcement response.

Thanks,

s.19(1)

Michelle Imbeau

Communications Advisor

Canadian Coast Guard / Fisheries and Oceans Canada / Government of Canada

Michelle.Imbeau@dfo-mpo.gc.ca / Tel: 604-666-2872 / Cell: [REDACTED]

Conseillère en communications

Garde côtière canadienne / Pêches et Océans Canada / Gouvernement du Canada

Michelle.Imbeau@dfo-mpo.gc.ca / Tél : 604-666-2872 / Tél cel : [REDACTED]

s.16(2)(c)

No further information has been removed or severed from this page

Waddington, Zac

From: Waddington, Zac
Sent: May-14-18 3:57 PM
To: Rainer, Michelle; Doucette, Claire
Subject: RE: For approval: media lines

Sorry for the delayed response, I was in a conference call for way too long. But I think they look good, and will defer to Claire about the enforcement.

Zac

From: Rainer, Michelle
Sent: May-14-18 2:36 PM
To: Doucette, Claire
Cc: Waddington, Zac
Subject: Re: For approval: media lines

OK I understand now. Will do, thanks

Sent from my BlackBerry 10 smartphone on the Rogers network.

From: Doucette, Claire
Sent: Monday, May 14, 2018 2:32 PM
To: Rainer, Michelle
Subject: RE: For approval: media lines

Michelle, I am just concerned that if it is a really bad outbreak, the reporter is going to ask well will you charge them, why just a letter? We can't and that will take us down another rabbit hole. By stating the following,

.....however, if there has been noncompliance with the license conditions, DFO will address the matter with an appropriate enforcement response.

I believe this is cleaner.

Claire

From: Rainer, Michelle
Sent: Monday, May 14, 2018 2:26 PM
To: Doucette, Claire <Claire.Doucette@dfo-mpo.gc.ca>
Cc: Waddington, Zac <Zac.Waddington@dfo-mpo.gc.ca>
Subject: Re: For approval: media lines

OK thanks. Ok if I just say we would issue the letter?

Sent from my BlackBerry 10 smartphone on the Rogers network.

From: Doucette, Claire
Sent: Monday, May 14, 2018 1:44 PM
To: Rainer, Michelle
Subject: RE: For approval: media lines

Michelle, my only issue with that response is that it may lead the reporter to ask if we would charge if the issue is bad enough and until the COL's are changed we can never charge. Looks bad for us.

From: Rainer, Michelle

Sent: Monday, May 14, 2018 1:19 PM

To: Doucette, Claire <Claire.Doucette@dfo-mpo.gc.ca>; Carlson, Mike <Mike.Carlson@dfo-mpo.gc.ca>; Waddington, Zac <Zac.Waddington@dfo-mpo.gc.ca>

Cc: Ford, Leanne <Leanne.Ford@dfo-mpo.gc.ca>

Subject: RE: For approval: media lines

Thanks, Claire. I'll just say :

Please note that this is not a formal investigation under the *Fisheries Act* or regulations; however, if there has been non-compliance with licence conditions, DFO will issue a formal letter of non-compliance."

Zac, could I also add something like: "and advise on how compliance can be ensured in future." Or something like that?

From: Doucette, Claire

Sent: May-14-18 1:12 PM

To: Rainer, Michelle; Carlson, Mike

Cc: Ford, Leanne

Subject: RE: For approval: media lines

Sorry Michelle, I was in transit. I am not sure if saying further enforcement actions is prudent because the way the condition of license is written, the only thing we can do is issue a letter. C+P's hands are tied at this point. As long as the company has a plan, that's all we can enforce and they do have a plan. Perhaps put afterDFO, will address the matter with an appropriate enforcement response.

Claire

From: Rainer, Michelle

Sent: Monday, May 14, 2018 12:59 PM

To: Carlson, Mike <Mike.Carlson@dfo-mpo.gc.ca>

Cc: Doucette, Claire <Claire.Doucette@dfo-mpo.gc.ca>; Ford, Leanne <Leanne.Ford@dfo-mpo.gc.ca>

Subject: For approval: media lines

Hi Mike,

I'm not sure if Claire is available today and we are under deadline. Can you please review these media lines?

Thanks,

Michelle

Issue: [REDACTED] CBC [REDACTED] is doing a follow-up story on the elevated sea lice levels at Cermaq farms in Clayoquot. Cermaq Canada is voluntarily withdrawing its ASC certification on its fish until the sea lice is under control.

Deadline: May 14, 4 p.m. PST

Recommendation: email lines

Approved by: Zac Waddington

Media lines:

s.19(1)

- Fisheries and Oceans Canada (DFO) is reviewing Cermaq Canada's sea lice management practices at these farms to determine if relevant licence conditions have been followed appropriately.
- Our fish health veterinarians have requested documentation to determine the appropriateness of treatments undertaken at farms, and to ensure that all other treatment and harvest options were duly considered by Cermaq. Financial considerations would not be recognized as justification for exclusion of otherwise effective lice management options.
- Please note that this is not a formal investigation under the *Fisheries Act* or regulations; however, if there has been non-compliance with licence conditions, DFO will issue a formal letter of non-compliance and consider further enforcement options.

From: Waddington, Zac
Sent: May-14-18 12:50 PM
To: Rainer, Michelle; Doucette, Claire
Subject: RE: Cermaq sea lice media request

My thoughts. I did edit bullet two a bit as well.

- Fisheries and Oceans Canada (DFO) is reviewing Cermaq Canada's sea lice management practices at these farms to determine if relevant licence conditions have been followed appropriately.
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Zac

s.19(1)

s.21(1)(b)

From: Rainer, Michelle
Sent: May-14-18 11:56 AM
To: Waddington, Zac; Doucette, Claire
Subject: Cermaq sea lice media request
Importance: High

Hi Zac,

How is this? Can you fill in the blank at the end outlining any measures/changes that may be required of Cermaq?

Claire, can you please review the wording explaining it's not a formal investigation? This reporter previously receive the version that implied it was.

Thanks,
Michelle

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Deadline: May 14, 4 p.m. PST

Recommendation: email lines

Approved by:

Media lines:

- Fisheries and Oceans Canada (DFO) is reviewing Cermaq Canada's sea lice management practices at these farms to determine if relevant licence conditions have been followed appropriately.
- Our fish health veterinarians have requested records documenting the treatment options Cermaq used or considered and to assess whether therapeutants were used appropriately. Financial considerations would not be recognized as justification for exclusion of otherwise effective lice management options.
- Please note that this is not a formal investigation under the *Fisheries Act* or regulations; however, based the results of DFO's review, the company may be required to ????

Bate, Dan

From: Bate, Dan
Sent: May-14-18 5:33 PM
To: [REDACTED]
Cc: RHQ - Media.PAC
Subject: CBC, Cermaq Clayoquot Sound sea lice

Hi [REDACTED]

Understood you had some questions regarding sea lice at Cermaq Canada's facilities in Clayoquot Sound. Here with some more information for you about DFO's role/the situation.

- DFO is aware of the sea lice exceedances at Cermaq Canada's facilities in Clayoquot and has been in ongoing discussions with the company since January 2018 about measures to reduce sea lice levels.
- Under the Pacific Aquaculture Regulations, DFO requires salmon farming companies to regularly monitor and manage sea lice levels at their facilities in BC. DFO also regularly conducts assessments of sea lice abundance at these facilities. Companies in BC must submit a lice reduction plan if monitoring shows sea lice levels higher than three motile sea lice per farmed fish during the wild salmon outmigration period from March 1 to June 30 of each year. Motile lice are those at the free-moving stages of their life cycle.
- Salmon farming companies use an in-feed therapeutant called SLICE (emamectin benzoate) to reduce lice abundance. In cases where the use of SLICE does not result in adequate reduction of sea lice, companies can apply to the province of British Columbia for a permit to use alternative treatments, including Paramove (a hydrogen peroxide bath). Please contact Cermaq or the Province of BC's Ministry of Agriculture for further information on this process.
- Hydrogen peroxide is widely used around the world, including elsewhere on Canada's west coast, with excellent effect and no demonstrable effects to the ecosystem. This pesticide is not absorbed by the fish and is non-toxic to humans. It also dissipates as a neutralized substance quickly in the environment and causes no discernible far-field effect.
- DFO is looking into the management of lice at farms in Clayoquot by Cermaq Canada to determine if there has been non-compliance with the licence conditions and cannot comment further at this time.
- DFO makes reports on the numbers of sea lice at BC aquaculture farms available to the public at www.dfo-mpo.gc.ca/aquaculture/protect-protege/parasites-eng.html.
- Fisheries and Oceans Canada (DFO) is reviewing Cermaq Canada's sea lice management practices at these farms to determine if relevant licence conditions have been followed appropriately.
- Our fish health veterinarians have requested documentation to determine the appropriateness of treatments undertaken at farms, and to ensure that all other treatment and harvest options were duly considered by Cermaq. Financial considerations would not be recognized as justification for exclusion of otherwise effective lice management options.
- Please note that this is not a formal investigation under the *Fisheries Act* or regulations; however, if there has been non-compliance with the licence conditions, DFO will address the matter with an appropriate enforcement response.

s.19(1)

Dan Bate

A/Regional Director, Communications

Fisheries and Oceans Canada Pacific Region / Canadian Coast Guard / Government of Canada

Dan.Bate@dfo-mpo.gc.ca / Tel: (604) 775-8809 / Cell: [REDACTED]

A/Directeur régional des communications

Pêches et Océans Canada, région du Pacifique / Garde côtière canadienne / Gouvernement du Canada

Dan.Bate@dfo-mpo.gc.ca / Tél : (604) 775-8809 / Tél. cell. : [REDACTED]

s.16(2)(c)

Bate, Dan

From: Bate, Dan
Sent: May-15-18 9:20 AM
To: Rainer, Michelle
Cc: Imbeau, Michelle
Subject: FW: For approval: CBC, Cermaq Clayoquot Sound sea lice

FYI

From: Reid, Rebecca
Sent: May-14-18 5:29 PM
To: Bate, Dan
Cc: Johal, Sharan; Kaba, Kyle; Girouard, Louise
Subject: RE: For approval: CBC, Cermaq Clayoquot Sound sea lice

Hi Dan – OK, it makes a lot more sense with these lines included. I guess I would hope that we don't just go straight to the specifics, but that we provide that broader context. Otherwise it takes it from routine and normal to extraordinary. While it is true we are concerned about high lice levels, we also know there are ways to address the issue, and it is part of our routine activities to check this, and other issues related to compliance to licence conditions.

RR

Rebecca Reid
Regional Director General/ Directrice générale régionale
Fisheries and Oceans Canada - Pacific Region/ Pêches et Océans Canada - Région du Pacifique
200-401 Burrard Street / 401, rue Burrard, bureau 200
Vancouver, BC/CB V6C 3S4
Office / Téléphone: 604-666-6098
Cell / Cellulaire: [REDACTED]
E-mail/ Courriel: rebecca.reid@dfo-mpo.gc.ca

From: Bate, Dan
Sent: Monday, May 14, 2018 5:25 PM
To: Reid, Rebecca <Rebecca.Reid@dfo-mpo.gc.ca>
Cc: Johal, Sharan <Sharan.Johal@dfo-mpo.gc.ca>; Kaba, Kyle <Kyle.Kaba@dfo-mpo.gc.ca>; Girouard, Louise <Louise.Girouard@dfo-mpo.gc.ca>
Subject: RE: For approval: CBC, Cermaq Clayoquot Sound sea lice

Hi Rebecca – earlier lines on this were approved by Bonnie two weeks ago (May 7).

Our intention here was to provide the reporter with abit more detail than that was given out earlier, but if you'd prefer we could go with the following:

- DFO is aware of the sea lice exceedances at Cermaq Canada's facilities in Clayoquot and has been in ongoing discussions with the company since January 2018 about measures to reduce sea lice levels.
- Under the Pacific Aquaculture Regulations, DFO requires salmon farming companies to regularly monitor and manage sea lice levels at their facilities in BC. DFO also regularly conducts assessments of sea lice abundance at these facilities. Companies in BC must submit a lice reduction plan if monitoring shows sea lice levels higher than s.16(2)(c)

three motile sea lice per farmed fish during the wild salmon outmigration period from March 1 to June 30 of each year. Motile lice are those at the free-moving stages of their life cycle.

- Salmon farming companies use an in-feed therapeutant called SLICE (emamectin benzoate) to reduce lice abundance. In cases where the use of SLICE does not result in adequate reduction of sea lice, companies can apply to the province of British Columbia for a permit to use alternative treatments, including Paramove (a hydrogen peroxide bath). Please contact Cermaq or the Province of BC's Ministry of Agriculture for further information on this process.
- Hydrogen peroxide is widely used around the world, including elsewhere on Canada's west coast, with excellent effect and no demonstrable effects to the ecosystem. This pesticide is not absorbed by the fish and is non-toxic to humans. It also dissipates as a neutralized substance quickly in the environment and causes no discernible far-field effect.
- DFO is looking into the management of lice at farms in Clayoquot by Cermaq Canada to determine if there has been non-compliance with the licence conditions and cannot comment further at this time.
- DFO makes reports on the numbers of sea lice at BC aquaculture farms available to the public at www.dfo-mpo.gc.ca/aquaculture/protect-protege/parasites-eng.html.

From: Reid, Rebecca
Sent: May-14-18 4:42 PM
To: Bate, Dan
Cc: Johal, Sharan; Kaba, Kyle; Girouard, Louise
Subject: Re: For approval: CBC, Cermaq Clayoquot Sound sea lice

Hi Dan - I find the responses a bit direct and quite technical - Is it intended to respond to specific questions about noted sea lice levels at this farm?

It might be helpful to have a couple lines on sea lice levels in farms being monitored, that management measures are put in place when levels are found to be elevated, and this is regular farm business.

DFO has a monitoring role, etc... why would we get into the details of this incident? And if we do want to get into the details, let's provide some context around our activities anyway.

RR

Sent from my BlackBerry 10 smartphone on the Rogers network.

From: Bate, Dan
Sent: Monday, May 14, 2018 3:14 PM
To: Reid, Rebecca
Cc: Johal, Sharan; Kaba, Kyle; Girouard, Louise
Subject: For approval: CBC, Cermaq Clayoquot Sound sea lice

Hi Rebecca – looking for your ok on the following set of media lines. Apparently Cermaq Canada is voluntarily withdrawing its ASC certification at this time.

Thanks,
Dan

s.19(1)
s.21(1)(b)

Issue: [REDACTED] CBC [REDACTED] is doing a follow-up story on the elevated sea lice levels at Cermaq farms in Clayoquot. Cermaq Canada is voluntarily withdrawing its ASC certification on its fish until the sea lice is under control.

Deadline: May 14, 4 p.m. PST

Recommendation: email lines

Approved by: Zac Waddington, Claire Doucette, Allison Webb, Dan Bate

Media lines:

- Fisheries and Oceans Canada (DFO) is reviewing Cermaq Canada's sea lice management practices at these farms to determine if relevant licence conditions have been followed appropriately.
- Our fish health veterinarians have requested documentation to determine the appropriateness of treatments undertaken at farms, and to ensure that all other treatment and harvest options were duly considered by Cermaq. Financial considerations would not be recognized as justification for exclusion of otherwise effective lice management options.
- Please note that this is not a formal investigation under the *Fisheries Act* or regulations; however, if there has been non-compliance with the licence conditions, DFO will address the matter with an appropriate enforcement response.

Dan Bate

A/Regional Director, Communications

Fisheries and Oceans Canada Pacific Region / Canadian Coast Guard / Government of Canada

Dan.Bate@dfo-mpo.gc.ca / Tel: (604) 775-8809 / Cell: [REDACTED]

A/Directeur régional des communications

Pêches et Océans Canada, région du Pacifique / Garde côtière canadienne / Gouvernement du Canada

Dan.Bate@dfo-mpo.gc.ca / Tél : (604) 775-8809 / Tél. cell. : [REDACTED]

s.16(2)(c)

s.19(1)

Paylor, Adrienne

From: Paylor, Adrienne
Sent: May-15-18 1:17 PM
To: Plummer, Greg
Subject: FW: Clayoquot lice management

Hi Greg,

In follow up to our conversation last week, below is the email sent from our vet to Cermaq's vet requesting more information regarding the situation in Clayoquot. We expect a response by the end of the week and will let you know if we have any further questions. I wasn't sure if I should cc Joe on this so I will leave it up to you to debrief him if you feel it necessary.

Thanks,
Adrienne

From: Keith, Ian
Sent: Tuesday, May 15, 2018 11:20 AM
To: Paylor, Adrienne
Cc: Waddington, Zac
Subject: FW: Clayoquot lice management

From: [REDACTED]
Sent: May-13-18 2:47 AM
To: Keith, Ian
Cc: Waddington, Zac
Subject: Re: Clayoquot lice management

Thanks Ian. I will make sure everyone is informed and start on a response no day. [REDACTED]

[REDACTED]

[REDACTED]

s.19(1)

CERMAQ

Phone +1 250-286-0022
Direct +1 250-286-0022 ext [REDACTED]
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Cermaq.ca [Facebook](#) [Twitter](#)

On May 11, 2018, at 4:02 PM, Keith, Ian <Ian.Keith@dfo-mpo.gc.ca> wrote:

Hi [REDACTED]

DFO veterinarians have been monitoring the management of lice in Clayoquot, and have been in discussions with fish health and veterinary staff at Cermaq regarding plans for lice management since Fall 2017. These plans changed throughout early 2018, from 1) a January 11 plan to SLICE treat one farm pending favourable bioassay, and immediate harvest in anticipation of the outmigration period for those 3 farms where SLICE treatment was contraindicated ; to 2) a April 30 plan to peroxide-treat farms where there was exceedance during the outmigration period where SLICE treatment is contraindicated, and manage by harvest at the others. Note that the DFO response January 12 to the January 11 plan stated that when using harvest as a management tool in advance of the outmigration period, that harvesting would have to be finished by the end of February.

Millar is the only farm that has been harvested-out, to date, and none of Ross, Dixon, Mussel and Saranac, where the lice management plan is harvest, have met the required outcome of reduction in "absolute sea lice inventory" (as per licence condition 6.4(a)), based on lice data currently available to us (using average month inventory x average abundance).

While we appreciate the challenges, including delays in acquiring a Pesticide Use Permit for peroxide, we require further explanation and evidence that indicate to DFO what options have been pursued and exhausted by Cermaq that justify the current state of lice burden on numerous farms in Clayoquot. Specifically:

- Area-based SLICE treatment in late September to early October at numerous sites in Clayoquot had reduced efficacy and duration of effect than what is expected. Please demonstrate how appropriate therapeutic SLICE use was ensured as per Merck's Slice Sustainability Project.
- How were other treatment measures considered such as increased processing capacity at other facilities, use of Marine Harvest Canada's Hydrolicer, an earlier start to harvest at affected farms, and any other options considered?
- What, if any, monitoring of smolt lice burden has Cermaq conducted to monitor for effects on wild salmon smolts?

Please provide any information and/or documents to address the questions or that will assist in our assessment of compliance regarding this issue. I look forward to hearing from you by May 18, 2018. If you have any questions or required further clarification please do not hesitate to contact Zac Waddington at 250-703-0902 or Ian Keith at 250-703-0917.

Thanks for your attention concerning this issue.

Regards,
Ian

Dr. Ian Keith DVM
Field Operations Veterinarian – Pacific Region
Fisheries and Oceans Canada | Pêches et Océans Canada
Fisheries Management
Aquaculture Management Division | Gestion de l'aquaculture
Aquaculture Environmental Operations – Fish Health
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Mobile | Portable: [REDACTED]
Fax | Télécopieur: 250-703-0921
Ian.Keith@dfo-mpo.gc.ca

s.16(2)(c)

s.19(1)

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Waddington, Zac

From: Waddington, Zac
Sent: May-18-18 9:30 AM
To: Jensen, Neil; Doucette, Claire
Cc: Walde, Kirsty; Knight, Joe; Manore, Chris; Paylor, Adrienne
Subject: RE: Clayoquot sea lice graphs

Thanks very much for looking into this. I was not yet working for DFO in the spring of 2017 with the Esperanza lice issue, but from my understanding, this situation is different, [REDACTED]

[REDACTED] We have graphed the absolute sea lice inventory on farms over threshold, and found that the management plan submitted by Cermaq (harvesting), did not meet the criteria of reducing absolute sea lice inventory in the month of March, and graphs for the month of April are pending. I shared the graphs with Claire and can redistribute if necessary (or you can also just speak to Krista S. directly).

All that said, I recognize and agree that our COL are very weak in many areas, and would support opening the licence to change and strengthen our conditions to make them enforceable. In the interim, I was just hoping that this situation in Clayoquot could be reviewed [REDACTED] Unlike the previous situation in Esperanza, here we have documentation demonstrating the failure of their plan to reduce absolute sea lice inventory as per a condition of licence.

Zac

From: Jensen, Neil
Sent: May-17-18 9:05 AM
To: Doucette, Claire; Waddington, Zac
Cc: Walde, Kirsty; Knight, Joe; Manore, Chris
Subject: RE: Clayoquot sea lice graphs

Hi Claire and Zac,

C&P staff looked at this COL in the past and recommended a change as it was not viewed as enforceable. As I understand it, despite the recommendation, no changes were made to the COL and the current wording became fixed for the duration of the licence. A major limitation of the multi-year licences is that COLs may not be amended except for "the purposes of the conservation and protection of fish" (Fishery (General) Regulations, sec. 22(2)). This issue came up last year with an issue of large numbers of sea lice at Grieg on the West coast of Vancouver Island and C&P was asked investigate. However, the only thing that the company can be compelled or held legally accountable for is "implementing a plan" – whatever that means. There is no measure or quantifiable action that we can determine happened or not (i.e. within a prescribed time period). As long as the company has a plan and implements it, they are in compliance of the COL. For example, if they discovered the sea lice and ordered up hydrogen peroxide treatments and a well boat, but it will take 6 months to get in place in order to reduce the number of sea lice, they would be compliant. [REDACTED]

The only avenue that I can recommend is that you try to convince Allison [REDACTED] that the COL needs to be changed for conservation and protection reasons (for wild fish). They may have considered this last year, but I wasn't involved in

s.21(1)(b)

any of those discussions if they did occur. If there is agreement that the COL can be amended, C&P staff would be happy to help you develop an enforceable COL.

Neil Jensen

Fishery Officer / Agent des pêches

Senior Compliance Officer / Conservation and Protection / Aquaculture
Fisheries and Oceans Canada / Government of Canada

Neil.Jensen@dfo-mpo.gc.ca / Tel : 250-754-0386

2 – 1965 Island Diesel Way, Nanaimo, BC V9S 5W8

Agent principal d'application de la réglementation / Conservation et Protection / Aquaculture
Pêches et Océans Canada / Gouvernement du Canada

Neil.Jensen@dfo-mpo.gc.ca / Tél: 250-754-0386

2 – 1965, chemin Island Diesel, Nanaimo, CB V9S 5W8

From: Doucette, Claire

Sent: May-17-18 7:30 AM

To: Waddington, Zac

Cc: Jensen, Neil; Walde, Kirsty

Subject: FW: Clayoquot sea lice graphs

Zac, I am sorry, I was in meetings for most of yesterday and didn't have a chance to read through this however, as discussed Neil Jensen is well aware of the COL and the issues surrounding sea lice. Neil, Zac is seeking clarification on the issue surrounding our capacity to charge. [REDACTED] Zac has provided below his information. I appreciate shellfish is your bailiwick but you know a lot on the matter. Kirsty, feel free to feed in.

Thank you
Claire

From: Waddington, Zac

Sent: Wednesday, May 16, 2018 9:43 PM

To: Doucette, Claire <Claire.Doucette@dfo-mpo.gc.ca>

Subject: RE: Clayoquot sea lice graphs

Sorry to bug you again, but I'm curious if you've had a chance to review this and what your thoughts were regarding it?

Zac

From: Waddington, Zac

Sent: May-14-18 4:15 PM

To: Doucette, Claire

Subject: FW: Clayoquot sea lice graphs

Please see the hyperlink below which has numerous graphs based on industry reported sea lice data. Please focus on the "Total Lice Abundance" tab which demonstrates the absolute sea lice inventory on the various farms. This is calculated by multiplying the mid-month inventory on farm, by an average of the month's sea lice counts; therefore we only get one data point per month. Industry reports their monthly inventory and sea lice numbers for each month, on the month following by the 15th. Therefore, our current graphs only have data up until the end of March, but by tomorrow we could update these graphs until the end of April. Based on the lice numbers I've seen, there is no expectation that things have improved, with the exception of Millar Channel which has been harvested out.

s.21(1)(b)

Even based on just data in March (the 1st month of the outmigration period), you can see that all farms have had an upwards trend in "absolute sea lice inventory," and Bawden, Dixon Bay, Millar Channel, Ross Pass and Saranac Island are all over threshold.

Based on this, we (at AEO) believe that they have not met the licence condition which dictates that their plan "will reduce the absolute sea lice inventory within the containment structure array." See below:

6.4 Starting March 1, 2017, the licence holder must conduct annual sampling between March 1 and June 30 for the term set out in this licence. The licence holder cultivating Atlantic salmon and trout must carry out a sea lice abundance assessment every two weeks, at minimum, for fish held in containment structures for more than 30 calendar days. Where data collected in Appendix VI-A indicates the sea lice abundance threshold of three motile *Lepeophtheirus salmonis* has been exceeded, the licence holder must:

- (a) within 15 calendar days of the discovery, implement a plan which will reduce the absolute sea lice inventory within the containment structure array; and
- (b) notify the Department as per section 7.1 and 7.3.

I hope that helps, please let me know if we can help further.

Zac

From: Sandberg, Krista
Sent: May-09-18 2:17 PM
To: Waddington, Zac; Paylor, Adrienne; Keith, Ian
Subject: Clayoquot sea lice graphs

I've updated the file to include a graph on total # lice on farm using midmonth inventory and monthly average lice abundance.

File saved here: X:\AEO\Courtenay\FH\sea lice management\Sea Lice - Clayoquot graphs 2017.xls

Note that we will be able to add April to this time series next week.

Krista Sandberg
Aquaculture Data Manager | Gestionnaire de données sur l'aquaculture
Aquaculture Management Division | Gestion de l'aquaculture
Fisheries and Oceans Canada | Pêches et Océans Canada
krista.sandberg@dfo-mpo.gc.ca
Office | Bureau 250-286-5835
Cellular | Cellulaire [REDACTED]



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Canada

s.16(2)(c)

Waddington, Zac

From: Waddington, Zac
Sent: May-18-18 12:10 PM
To: [REDACTED]; Keith, Ian
Cc: [REDACTED]
Subject: RE: Clayoquot lice management

Thank you very much for that information. We will review it and get back to you by early next week.
Sincerely,

Dr. Zac Waddington DVM, B.Env.Sc.(Hons)
Lead Veterinarian - Pacific Region
Fisheries and Oceans Canada | Pêches et Océans Canada
Aquaculture Environmental Operations - Fish Health
Courtenay, British Columbia
Telephone | Téléphone: 250-703-0902
Fax | Télécopieur: 250-703-0921
Zac.Waddington@dfo-mpo.gc.ca

From: [REDACTED]
Sent: May-18-18 9:55 AM
To: Keith, Ian
Cc: Waddington, Zac; [REDACTED]
Subject: Re: Clayoquot lice management

Hi - see attached. I will be in the office this afternoon if you have questions.

[REDACTED]

[REDACTED]

CERMAQ

Phone +1 250-286-0022
Direct +1 250-286-0022 ext [REDACTED]
Mobile + [REDACTED]

Cermaq Canada Ltd.
203 - 919 Island Hwy
V9W 2C2 Campbell River, BC, Canada

s.19(1)

Cermaq.ca [Facebook](#) [Twitter](#)

From: [REDACTED]
To: "Keith, Ian" <Ian.Keith@dfo-mpo.gc.ca>
Cc: "Waddington, Zac" <Zac.Waddington@dfo-mpo.gc.ca>
Date: 13/05/2018 02:47 AM
Subject: Re: Clayoquot lice management

Thanks Ian. I will make sure everyone is informed and start on a response no day. [REDACTED]

On May 11, 2018, at 4:02 PM, Keith, Ian <Ian.Keith@dfo-mpo.gc.ca> wrote:

Hi [REDACTED]

DFO veterinarians have been monitoring the management of lice in Clayoquot, and have been in discussions with fish health and veterinary staff at Cermaq regarding plans for lice management since Fall 2017. These plans changed throughout early 2018, from 1) a January 11 plan to SLICE treat one farm pending favourable bioassay, and immediate harvest in anticipation of the outmigration period for those 3 farms where SLICE treatment was contraindicated ; to 2) a April 30 plan to peroxide-treat farms where there was exceedance during the outmigration period where SLICE treatment is contraindicated, and manage by harvest at the others. Note that the DFO response January 12 to the January 11 plan stated that when using harvest as a management tool in advance of the outmigration period, that harvesting would have to be finished by the end of February.

Millar is the only farm that has been harvested-out, to date, and none of Ross, Dixon, Mussel and Saranac, where the lice management plan is harvest, have met the required outcome of reduction in "absolute sea lice inventory" (as per licence condition 6.4(a)), based on lice data currently available to us (using average month inventory x average abundance).

While we appreciate the challenges, including delays in acquiring a Pesticide Use Permit for peroxide, we require further explanation and evidence that indicate to DFO what options have been pursued and exhausted by Cermaq that justify the current state of lice burden on numerous farms in Clayoquot. Specifically:

- Area-based SLICE treatment in late September to early October at numerous sites in Clayoquot had reduced efficacy and duration of effect than what is expected. Please demonstrate how appropriate therapeutic SLICE use was ensured as per Merck's Slice Sustainability Project.
- How were other treatment measures considered such as increased processing capacity at other facilities, use of Marine Harvest Canada's Hydrolicer, an earlier start to harvest at affected farms, and any other options considered?
- What, if any, monitoring of smolt lice burden has Cermaq conducted to monitor for effects on wild salmon smolts?

Please provide any information and/or documents to address the questions or that will assist in our assessment of compliance regarding this issue. I look forward to hearing from you by May 18, 2018. If you have any questions or required further clarification please do not hesitate to contact Zac Waddington at 250-703-0902 or Ian Keith at 250-703-0917.

Thanks for your attention concerning this issue.

Regards,
Ian

Dr. Ian Keith DVM
Field Operations Veterinarian – Pacific Region
Fisheries and Oceans Canada | Pêches et Océans Canada
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Diamond, Maria

From: Manchester, Howie
Sent: 2018-May-22 8:20 AM
To: Diamond, Maria
Cc: Waddington, Zac
Subject: RE: Bioassay

Thanks for this Maria, I think the earliest this would happen (if it happens at all) would be May 31 (therefore must be read Saturday). We could make a special trip to the site earlier one week to do this if need be, will have to talk to Zac.

Thanks

Howie

From: Diamond, Maria
Sent: May-18-18 10:52 AM
To: Manchester, Howie
Subject: Bioassay

Hey Howie,

I spoke [REDACTED] first thing this morning regarding Bioassays. She says they provide a kit that includes everything we would need to do the collection and transport (coolers, air stones, container – for onsite seawater collection as well, etc.). The only thing they do not provide is forceps because they tend to get lost/dropped. So we can pick up the equipment from CAHS no problem.

How the bioassay works is that Day 1 is the collection day, Day 2 is the Bioassay and Day 3 is the 24 hour post-bioassay read. [REDACTED]

At this time all she needs is a lead time of the week prior to when a collection is planned. She will send me an SOP for the process.

Maria

Maria Diamond, B.Sc.

Aquatic Science Biologist / Biologiste en sciences aquatiques
Aquaculture Management Division / Gestion de l'aquaculture
Aquaculture Environmental Operations/Opérations environnementales de l'aquaculture
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Waddington, Zac

From: Waddington, Zac
Sent: May-23-18 1:16 PM
To: Jensen, Neil
Subject: RE: Your Voice Mail Today

Thanks for that. I'll follow up.

Zac

From: Jensen, Neil
Sent: May-23-18 11:59 AM
To: Waddington, Zac
Subject: RE: Your Voice Mail Today

I'm not sure as I just found out about it. Bernie said that it was expected to occur fairly soon. However, in gov't, "fairly soon" often means something different than what you and I would think... Adrienne would probably know.

Neil Jensen

Fisheries & Oceans Canada / Pêches et Océans Canada
Conservation & Protection / Conservation et Protection

From: Waddington, Zac
Sent: May-23-18 11:57 AM
To: Jensen, Neil
Subject: RE: Your Voice Mail Today

Yes I did briefly chat with him about that. What's the time frame for that marine mammal section to be amended?

Zac

From: Jensen, Neil
Sent: May-23-18 11:56 AM
To: Waddington, Zac
Subject: RE: Your Voice Mail Today

Good luck! As for getting the COL changed, try speaking to Bernie as he thought there may be opportunity to change it at the same time as the marine mammal section.

Neil Jensen

Fisheries & Oceans Canada / Pêches et Océans Canada
Conservation & Protection / Conservation et Protection

From: Waddington, Zac
Sent: May-23-18 11:54 AM
To: Jensen, Neil
Cc: Doucette, Claire
Subject: RE: Your Voice Mail Today

Thanks very much for your response, I did have a chance to chat with Claire and she explained where C and P was at with regards to this case and numerous other shellfish cases. For now I have what I need to respond to Cermaq and will leave the ball with C and P regarding whether a case can/will be made regarding this sea lice issue in Clayoquot.

Zac

From: Jensen, Neil
Sent: May-23-18 11:25 AM
To: Waddington, Zac
Subject: Your Voice Mail Today

Hi Zac,

I'm sorry to have missed your call earlier. I suggest that you contact Claire or Joe Knight directly to discuss the letter and C&P response to your request to look at the sea lice issue. I give advice and work on policy issues, but Joe is the Detachment Supervisor that makes the decisions for operational activities, so I will defer to him (or Claire as Chief) to properly help you out. I gave them a heads up to call you today, but I'm not sure what they are up to today or their availability. I suggest that you calling either one if you don't hear from them by early afternoon.

Neil Jensen
Fishery Officer / Agent des pêches

Senior Compliance Officer / Conservation and Protection / Aquaculture
Fisheries and Oceans Canada / Government of Canada
Neil.Jensen@dfo-mpo.gc.ca / Tel : 250-754-0386
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Pêches et Océans Canada / Gouvernement du Canada
Neil.Jensen@dfo-mpo.gc.ca / Tél: 250-754-0386
2 – 1965, chemin Island Diesel, Nanaimo, CB V9S 5W8

Waddington, Zac

From: Keith, Ian
Sent: May-23-18 4:05 PM
To: Waddington, Zac
Subject: letter with potential edits
Attachments: Zac's draft response [REDACTED]1.docx

Follow Up Flag: Follow up
Flag Status: Completed

Style. I think you have covered all the salient points You're good.

Dr. Ian Keith DVM
Field Operations Veterinarian – Pacific Region
Fisheries and Oceans Canada | Pêches et Océans Canada
Fisheries Management
Aquaculture Management Division | Gestion de l'aquaculture
Aquaculture Environmental Operations – Fish Health
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Mobile | Portable: [REDACTED]
Fax | Télécopieur: 250-703-0921
Ian.Keith@dfo-mpo.gc.ca

s.16(2)(c)

s.19(1)

Thank you very much for your response and detailed information regarding sea lice management in Clayoquot. We have reviewed the data provided and your responses have demonstrated that Cermaq did indeed make due efforts to prevent this current state of lice in Clayoquot, and ~~taken~~ have taken efforts to monitor sea lice on ~~and mitigate impacts to~~ wild fish. However, according to our data Saranac was over threshold in March and April, and no data have been provided for that farm. Please provide similar data (if available) to what was provided for Dixon, Ross and Millar. We would also request any data regarding pre- and post-treatment bioassays conducted on farms treated in September and October 2017. We are hoping to complement our dataset of sea lice resistance demonstrated in other areas with these most recent cases. Finally, could you please provide us with the most current treatment sites and dates for Paramove in Clayoquot.

We appreciate your clarification regarding other treatment and processing options considered. Based on information provided, Cermaq's wild smolt monitoring program is ~~very~~ comprehensive, timely and laudable.

Cermaq has been forthcoming with our requests for further information and this is ~~greatly~~ appreciated. We note the ~~many~~ challenges faced with regards to lice management in Clayoquot in the recent past and it. ~~Nevertheless, this incident has highlighted~~ the short comings in our own sea lice conditions of licence concerning ~~and lack of resiliency in~~ harvest as a management tool during the outmigration. We will be considering how we can improve our own licence conditions in the future to ensure similar situations are prevented.

We have discussed this case with Conservation and Protection and have presented them with the relevant information and data. They are still in the process of determining how they wish to proceed. If you are able to provide us with the requested information then we in AEO Fish Health will be satisfied that we have a full picture of the steps taken by Cermaq to prevent and mitigate this current state of lice in Clayoquot.

Sincerely,

Dr. Zac Waddington DVM, B.Env.Sc.(Hons)

Lead Veterinarian - Pacific Region

Fisheries and Oceans Canada | Pêches et Océans Canada

Aquaculture Environmental Operations - Fish Health

Courtenay, British Columbia

Telephone | Téléphone: 250-703-0902

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Zac.Waddington@dfo-mpo.gc.ca

No information has been removed or severed from this page

Waddington, Zac

From: Waddington, Zac
Sent: May-23-18 3:10 PM
To: Keith, Ian

Thank you very much for your response and detailed information regarding sea lice management in Clayoquot. We have reviewed the data provided and your responses have demonstrated that Cermaq did indeed make due efforts to prevent this current state of lice in Clayoquot, and taken efforts to monitor and mitigate impacts to wild fish. However, according to our data Saranac was over threshold in March, and no data have been provided for that farm. Please provide similar data (if available) to what was provided for Dixon, Ross and Millar. We would also request any data regarding pre- and post-treatment bioassays conducted on farms treated in September and October 2017. We are hoping to complement our dataset of sea lice resistance demonstrated in other areas with these most recent cases. Finally, could you please provide us with the most current treatment sites and dates for Paramove in Clayoquot.

We appreciate your clarification regarding other treatment and processing options considered. Based on information provided, Cermaq's wild smolt monitoring program is very comprehensive, timely and laudable.

Cermag has been forthcoming with our requests for further information and this is greatly appreciated. We note the many challenges faced with regards to lice management in Clayoquot in the recent past. Nevertheless, this incident has highlighted the short comings in our own sea lice conditions of licence and lack of resiliency in harvest as a management tool during the outmigration. We will be considering how we can improve our own licence conditions in the future to ensure similar situations are prevented.

We have discussed this case with Conservation and Protection and have presented them with the relevant information and data. They are still in the process of determining how they wish to proceed. If you are able to provide us with the requested information then we in AEO Fish Health will be satisfied that we have a full picture of the steps taken by Cermaq to prevent and mitigate this current state of lice in Clayoquot.

Sincerely,

Dr. Zac Waddington DVM, B.Env.Sc.(Hons)
Lead Veterinarian - Pacific Region
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Zac.Waddington@dfo-mpo.gc.ca

Paylor, Adrienne

From: Paylor, Adrienne
Sent: May-24-18 11:27 AM
To: Jensen, Neil; Walde, Kirsty
Subject: FW: Clayoquot lice management

Just as an FYI for your files it looks like our AMD vet's have received some of the requested information from Cermaq and will continue to assess the situation. I will keep you informed as things move forward.

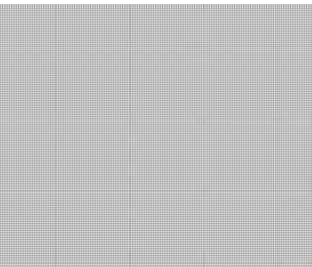
Thank you,
Adrienne

From: [REDACTED]
Sent: Wednesday, May 23, 2018 7:51 PM
To: Waddington, Zac
Cc: [REDACTED] Keith, Ian; Paylor, Adrienne; Webb, Allison
Subject: Re: Clayoquot lice management

Hello Zac

We sincerely appreciate your prompt reply will ensure we work to send to you the requested information as quickly as possible

Kind Regards



CERMAQ

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s.19(1)

On May 23, 2018, at 4:21 PM, Waddington, Zac <Zac.Waddington@dfo-mpo.gc.ca> wrote:

Thank you very much for your response and detailed information regarding sea lice management in Clayoquot. We have reviewed the data provided and your responses have demonstrated that Cermaq did indeed make due efforts to prevent this current state of lice in

Clayoquot, and have taken efforts to monitor sea lice on wild fish. Cermaq's wild smolt monitoring program is comprehensive, timely and laudable.

According to our data Saranac was over threshold in March and April, and no data have been provided for that farm. Please provide similar data (if available) to what was provided for Dixon, Ross and Millar. We would also request any data regarding pre- and post-treatment bioassays conducted on farms treated in September and October 2017. We are hoping to complement our dataset of sea lice resistance demonstrated in other areas with these most recent cases. Finally, could you please provide us with the most current treatment locations and dates for Paramove in Clayoquot.

Cermaq has been forthcoming with our requests for further information and this is appreciated. We are grateful for your clarification regarding other treatment and processing options considered. We recognize the challenges faced by Cermaq with regards to lice management in Clayoquot in the recent past, and this current situation highlights the shortcomings in our own conditions of licence and lack of resiliency in harvest as a management tool during the outmigration. We will be considering how we can improve our own licence conditions in the future to ensure similar situations are prevented.

We have discussed this case with Conservation and Protection and have presented them with the relevant information and data. They are still in the process of determining how they wish to proceed. If you are able to provide us with the information requested above, then we in AEO Fish Health will be satisfied that we have a full picture of the steps taken by Cermaq to prevent and mitigate this current state of lice in Clayoquot.

Sincerely,

Dr. Zac Waddington DVM, B.Env.Sc.(Hons)
Lead Veterinarian - Pacific Region
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Zac.Waddington@dfo-mpo.gc.ca

From: [REDACTED]
Sent: May-18-18 9:55 AM
To: Keith, Ian
Cc: Waddington, Zac; [REDACTED]
Subject: Re: Clayoquot lice management

Hi - see attached. I will be in the office this afternoon if you have questions.

[REDACTED]

s.19(1)

[REDACTED]



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Direct +1 250-286-0022 ext [REDACTED]
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From: [REDACTED]
To: "Keith, Ian" <Ian.Keith@dfo-mpo.gc.ca>
Cc: "Waddington, Zac" <Zac.Waddington@dfo-mpo.gc.ca>
Date: 13/05/2018 02:47 AM
Subject: Re: Clayoquot lice management

Thanks Ian. I will make sure everyone is informed and start on a response no day. [REDACTED]

On May 11, 2018, at 4:02 PM, Keith, Ian <Ian.Keith@dfo-mpo.gc.ca> wrote:

Hi [REDACTED]

DFO veterinarians have been monitoring the management of lice in Clayoquot, and have been in discussions with fish health and veterinary staff at Cermaq regarding plans for lice management since Fall 2017. These plans changed throughout early 2018, from 1) a January 11 plan to SLICE treat one farm pending favourable bioassay, and immediate harvest in anticipation of the outmigration period for those 3 farms where SLICE treatment was contraindicated; to 2) a April 30 plan to peroxide-treat farms where there was exceedance during the outmigration period where SLICE treatment is contraindicated, and manage by harvest at the others. Note that the DFO response January 12 to the January 11 plan stated that when using harvest as a management tool in advance of the outmigration period, that harvesting would have to be finished by the end of February.

Millar is the only farm that has been harvested-out, to date, and none of Ross, Dixon, Mussel and Saranac, where the lice management plan is harvest, have met the required outcome of reduction in "absolute sea lice inventory" (as per licence condition 6.4(a)), based on lice data currently available to us (using average month inventory x average abundance).

While we appreciate the challenges, including delays in acquiring a Pesticide Use Permit for peroxide, we require further explanation and evidence that indicate to DFO what options have been pursued and exhausted by Cermaq that justify the current state of lice burden on numerous farms in Clayoquot. Specifically:

- Area-based SLICE treatment in late September to early October at numerous sites in Clayoquot had reduced efficacy and duration of effect than what is expected. Please demonstrate how appropriate therapeutic SLICE use was ensured as per Merck's Slice Sustainability Project.
- How were other treatment measures considered such as increased processing capacity at other facilities, use of Marine Harvest Canada's Hydrolicer, an earlier start to harvest at affected farms, and any other options considered?

s.19(1)

- What, if any, monitoring of smolt lice burden has Cermaq conducted to monitor for effects on wild salmon smolts?

Please provide any information and/or documents to address the questions or that will assist in our assessment of compliance regarding this issue. I look forward to hearing from you by May 18, 2018. If you have any questions or required further clarification please do not hesitate to contact Zac Waddington at 250-703-0902 or Ian Keith at 250-703-0917.

Thanks for your attention concerning this issue.

Regards,
Ian

Dr. Ian Keith DVM
Field Operations Veterinarian – Pacific Region
Fisheries and Oceans Canada | Pêches et Océans Canada
Fisheries Management
Aquaculture Management Division | Gestion de l'aquaculture
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Ian.Keith@dfo-mpo.gc.ca

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s.16(2)(c)

Manchester, Howie

From: Manchester, Howie
Sent: May-24-18 4:30 PM
To: Diamond, Maria
Cc: Waddington, Zac; Charbonneau, Michelle; Waddington, Zac; Drinkwater, Alisha
Subject: Bioassay gear

Hi Maria,

Can you arrange [REDACTED] to get the gear for doing a Bio assay. Also ask her how many lice we need to collect, keeping in mind we want to determine resistance or not, we are not interested in the level of resistance as we are not planning a treatment (please convey this information [REDACTED] as the number of lice we collect may determine the level of resistance testing.

Ideally we can get the gear tomorrow but if not we can have either you or preferably Alisha bring it up next Wednesday. We would plan to bring the lice back from the farms late afternoon on Thursday, May 31.

Thanks

Howie

Howie Manchester BSc
Senior Aquatic Science Biologist
Fisheries and Oceans Canada / Pêches et Océans Canada
Aquaculture Management Division / Gestion de l'aquaculture
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Telephone | Téléphone: 250 703 0916 | Cell: [REDACTED]
Fax: 250 703 0921

s.16(2)(c)

s.19(1)


Manchester, Howie

From: Manchester, Howie
Sent: May-25-18 2:18 PM
To: Waddington, Zac
Cc: Keith, Ian
Subject: Sea lice Bioassay

Hi Zac,

Not to add more stress to your day, but do you know when/who will let us know next week about Bio assays, and which farm. We have the gear from CAHS and are ready. Would have to do this Thursday.

Howie

Howie Manchester BSc
Senior Aquatic Science Biologist
Fisheries and Oceans Canada / Pêches et Océans Canada
Aquaculture Management Division / Gestion de l'aquaculture
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Fax: 250 703 0921

s.16(2)(c)

Diamond, Maria

From: Waddington, Zac
Sent: 2018-May-25 2:20 PM
To: Manchester, Howie
Cc: Diamond, Maria
Subject: RE: Bioassay

Wow that is a lot. I've still not heard from Cermaq regarding their own bioassay results. If we don't hear anything by early next week, then I think we should make plans to collect those lice from a site with high numbers, and a treatment failure. I'll keep you posted

Zac

From: Manchester, Howie
Sent: May-25-18 9:25 AM
To: Waddington, Zac
Cc: Diamond, Maria
Subject: FW: Bioassay

Hi Zac,

Here is some info on the bioassay. We will pick up the kit today, but the lab will need some lead time to prepare and make sure they have staff available, I think we need to know by Wednesday morning at the latest whether this is happening or not. They need 600 lice of each species, so we need a site that is high in numbers.

Thanks

Howie

From: Diamond, Maria
Sent: May-25-18 9:04 AM
To: [REDACTED] Manchester, Howie
Cc: [REDACTED]
Subject: RE: Bioassay

Thanks [REDACTED]

I'll forward this to Howie so that he is aware of numbers, timing, costs, etc.

Will talk soon,

s.19(1)

Maria

From: [REDACTED]
Sent: 2018-May-25 9:01 AM
To: Diamond, Maria
Cc: [REDACTED]
Subject: RE: Bioassay

Hi Maria

Missed your call by one minute!

It is better to get the lice here on Thursday but it doesn't have to be by 4:30pm. I usually have to come back and meet someone around 6:30 or 7pm when it is a Tofino collection. I need the lice to sit in the incubator overnight to allow them to recover from TMS and transport.

If I do the assay on Friday, then I come in Saturday to the 24 hour read and there is an extra cost associated with that. Just so you are aware.

The number is hard to say (I don't count the lice as I collect!). As long as the bottom is covered like the photo in the SOP in all 4 containers, then that is more than enough. I need minimum 600 of each sex alive and healthy for the assay. We can assume that at least 30% die in transport and I usually cull another 20% when we are sorting.

I target the adult males and females for the assay so don't get picky about trying for all the motiles (the tiny pre-adults are too small). If there is enough pre-adult females collected, then I try to do a couple of trays of them as well. I don't ask that you spend any time trying to target the males as I know this is time consuming. It is better to just go for the lice that look big enough and I sort them out here. I also collect the egg strings off the females for other projects.

I will have kit ready right away for pick up and answer any questions I can as well!

Cheers,

From: Diamond, Maria [<mailto:Maria.Diamond@dfo-mpo.gc.ca>]

Sent: May 25, 2018 8:48 AM

To: [REDACTED]

Subject: Bioassay

Good Morning [REDACTED]

I just tried calling you to discuss setting up a Bioassay for next week because I had a couple of questions. So writing this in the meantime.

The plan is to collect lice on Thursday and bring them back late Thursday afternoon.... I need to find out if the team intends to get them here in time for someone to get them up to Campbell River Thursday or if it is ok to bring them up for first thing Friday morning (or is that too late for the bioassay set up?) as well this would mean doing the 24 hour read on Saturday

The other important question is "how many lice do we need to collect"?

Also is the kit ready to go now if someone ran up to CAHS to pick up?

Thanks

s.19(1)

Maria

Maria Diamond, B.Sc.

Aquatic Science Biologist / Biologiste en sciences aquatiques

Aquaculture Management Division / Gestion de l'aquaculture

Aquaculture Environmental Operations/Opérations environnementales de l'aquaculture

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SEA LICE COLLECTION DATASHEET

Collection Date:	
Collector(s):	
Collection contact info:	Company Name: _____
	Contact Name: _____ Tel: _____
	Contact Position: _____
Site name/info	Site Name: _____ Site Mgr: _____
	Fish Health Zone: _____ Age (Y1/Y2) _____
Collection/ Harvest info:	Surface Water Temp: _____ C Salinity: _____ ppt Water Visibility: _____ Weather: _____
	Method of Collection (circle): During Harvest / Anesthetized/ Other (specify)
	Harvest Boat Name: _____
	Approx. Lice count: _____ /fish
	Date of last lice treatment: _____ Medicant _____ # treatments: _____
Sealice condition at collection	Please circle: Healthy/live Weak/Moribund Mostly Dead
	Comments:
Transport Information:	Date of departure: _____
	Water Temperature at shipping: _____ C Water temperature at arrival: _____ C
	Time of Departure: _____ Time of Arrival to Cahs: _____
	Condition of lice at arrival (circle): Healthy/Live Weak Moribund Mostly Dead

Additional Comments

For Lab use only

CAHS #: _____

Waddington, Zac

From: Waddington, Zac
Sent: May-25-18 5:01 PM
To: Charbonneau, Michelle
Cc: Manchester, Howie; Keith, Ian
Subject: Re: Plan for Zone 2.3 Audits next week

Yes we are still waiting to hear back from Cermaq regarding their own bioassays. But if there's nothing by Tuesday then we will be planning to collect our own samples on Thursday. I understand that'll work with your field plans?? As for the site, I haven't figured out which would be best, but for sample collection feasibility it'll have to be one with high burden. I'll let you know once/if the sampling is confirmed.

Zac

From: Charbonneau, Michelle
Sent: Friday, May 25, 2018 2:33 PM
To: Waddington, Zac
Cc: Manchester, Howie
Subject: FW: Plan for Zone 2.3 Audits next week

Hey Zac,


Our plan for Tofino sites is below. We may be reselecting for the SL audit at Fortune (mouthrot treatment in progress).

Judging from Krista's SL graphs, I think you'll likely send us to Bawden, Ross or Dixon for the bio-assay (sites that showed increases post treatment), if we do that (Millar is harvested out, Ross and Dixon are expected to have less than three pens and be actively harvesting).

The possible replacements for Fortune's SL are Bawden or Bedwell. We can let the FHAS randomly select, or force it based on your input.

We would be deciding this by Tuesday afternoon at the latest.

Cheers,
MC

From: Charbonneau, Michelle
Sent: May-25-18 11:31 AM
To: 
Cc: Manchester, Howie; Stenhouse, Shawn
Subject: Plan for Zone 2.3 Audits next week

s.19(1)

s.20(1)(b)



Thanks for taking the time to clear that up. I've tried to outline the plan if we went ahead with SL at Fortune and the back-up plan if that isn't possible. Ideally Fortune will let us know their comfort with the SL audit by Tuesday afternoon.

I understand that Mussel Rock will be finishing up harvest Sunday/Monday, Millar is empty and both Ross and Dixon are [REDACTED]. That leaves Bedwell or Bawden as possible replacements for the SL audit at Fortune. If we know by Tuesday we can perform the reselection that evening and update both Bawden and Bedwell late on Tuesday so they know if they are to be ready or not.

I also understand Bare Bluff is undergoing net changes Monday and Tuesday and can accommodate their audit on Wednesday. We trust that Bare bluff will have reliable mortality collection at the time of the audit (i.e. divers if uplifts are not in the water due to net changes).

As discussed, let's keep the SL audit scheduled at Fortune for now and re-evaluate that on Tuesday. [REDACTED] we will reselect and both Bedwell and Bawden can be ready to sub in.

Here is the proposed area schedule. Please let us know asap if you have concerns; I'll need to send out the audit reminders (and heads up for Bedwell/Bawden) by 2:00pm today.

Site and Audit Type	Audit Day, ETA and Notes	Biosecurity / Site Order
Plover Point FH and SL Audits	Monday May 28 ETA 1115 Note: at this site DFO will have 2 staff and will plan to split up to tackle the FH and SL audits simultaneously upon arrival. Please be ready for that.	One site.
Saranac FH and SL Audits	Tuesday May 29 ETA 0800 (start SL)	Rant is first in biosecurity. Plan: drop one person at Saranac docking station in AM to start SL. Remaining DFO crew goes to Rant for SL and FH. When done at Rant, DFO crew can return to help out at Saranac.
Rant FH and SL Audits	Tuesday May 29 ETA 0815 Note: at this site DFO will have 2 staff and will plan to split up to tackle the FH and SL audits simultaneously upon arrival. Please be ready for that.	
Bare Bluff FH and SL Audits	Wednesday May 30 ETA 0830 Note: If we are doing SL at Fortune DFO will leave one staff at Bare Bluff in the AM to start SL. If we are not able to do SL at Fortune DFO will have 2 staff arrive at Bare Bluff and will plan to split up to tackle the FH and SL audits simultaneously upon arrival. Please be ready for that.	Fortune is first in biosecurity. *If fortune is comfortable conducting SL the plan is: drop one person at Bare Bluff docking station in AM to start SL. Remaining 2 DFO crew go to Fortune for SL and FH. When done at Fortune, DFO crew can return to help out at Bare Bluff.
Fortune FH and SL Audits*	Wednesday May 30 ETA 0845 * if SL	** [REDACTED] Fortune precludes SL sampling

s.20(1)(b)
s.21(1)(b)

	<p>ETA 0815 **if FH only</p> <p>Ideally, we will know Tuesday afternoon if staff at Fortune are comfortable handling fish for the SL audit.</p> <p>*If Fortune is comfortable doing the SL audit, DFO will have 2 staff and will plan to split up to tackle the FH and SL audits simultaneously upon arrival. Please be ready for that.</p> <p>**If Fortune is not comfortable doing the SL audit, DFO will drop one person here for the FH audit and either Bedwell or Bawden will be selected as the SL audit replacement. In this case the FH and SL audits at Bare Bluff would take place simultaneously.</p>	<p>the plan is: DFO drop one person at Fortune to conduct the FH audit, crew continues to Bare Bluff.</p> <p>Can our staff at Fortune get a ride with your FH to Bawden?</p>
<p>Bawden</p> <p>*Possible substitute for Fortune SL Nothing scheduled but please be ready for a SL Wednesday afternoon or Thursday morning.</p>	<p>Wednesday May 30 ETA 1400 (earlier if DFO gets a ride to Bawden with your FH from Fortune, later if DFO crew from Bare Bluff picks up DFO at Fortune and heads all together to Bawden). Or Thursday May 31 ETA 0815</p> <p>Ideally we would know Tuesday evening if Bawden needs to be ready on Wed/Thurs</p>	<p>If Bawden is selected as the replacement for Fortune's SL audit we will try to get there Wednesday, time permitting.</p> <p>I understand site order is Fortune<Bare Bluff<Bawden so our crew from Bare Bluff and from Fortune could feasibly go to Bawden after these audits for a SL audit.</p> <p>If we can't make it work Wednesday at Bawden, Thursday AM is the back-up.</p>
<p>Bedwell</p> <p>*Possible substitute for Fortune SL Nothing scheduled but please be ready for a SL Thursday morning.</p>	<p>Thursday May 31 ETA 0815</p> <p>Ideally we would know Tuesday evening if Bedwell needs to be ready on Thurs</p>	<p>If Bedwell is selected as the replacement for Fortune we can't go there after having been at Bare Bluff.</p> <p>So Bedwell would need to be ready Thursday AM for a SL audit.</p>

Regards,

Michelle Charbonneau MSc.

Aquatic Science Biologist / Biologiste en sciences aquatiques
Fisheries and Oceans Canada / Pêches et Océans Canada
Aquaculture Environmental Operations / Opérations environnementales de l'aquaculture
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Diamond, Maria

From: [REDACTED]
Sent: 2018-May-28 10:39 AM
To: Diamond, Maria
Subject: Sea Lice collection sheet
Attachments: Sea lice collection datasheet.docx

Hi Maria

I am attaching the Sea Lice Collection sheet for the staff to fill out when they collect lice. This info goes into a database we keep on bioassays.

Thanks

Cheers,

[REDACTED]

s.19(1)

Waddington, Zac

From: Sandberg, Krista
Sent: May-29-18 9:36 AM
To: Waddington, Zac; Manchester, Howie; Keith, Ian
Subject: RE: bioassay

Ok, I will do the April sea lice report today.

Krista.

Krista Sandberg

Office | Bureau 250-286-5835

Cellular | Cellulaire [REDACTED]



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From: Waddington, Zac
Sent: May-29-18 9:26 AM
To: Sandberg, Krista; Manchester, Howie; Keith, Ian
Subject: Re: bioassay

Thanks a bunch Krista. I know your super busy, but is there anyway you could generate the "absolute sea lice inventory" graph for sites using the April lice and inventory data as was done for March? It'll be important for C and P, I'm expecting to have a meeting with them later this week at some point.

Zac

From: Sandberg, Krista
Sent: Tuesday, May 29, 2018 11:16 AM
To: Manchester, Howie; Waddington, Zac; Keith, Ian
Subject: RE: bioassay

-I updated the inventory files yesterday. Miller and Ross are empty, and it looks like they are currently harvesting from Mussel and Saranac with plans to empty Dixon in June.

Krista.

Krista Sandberg

Office | Bureau 250-286-5835

Cellular | Cellulaire [REDACTED]



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From: Manchester, Howie
Sent: May-29-18 7:09 AM
To: Waddington, Zac; Keith, Ian
Cc: Sandberg, Krista
Subject: RE: bioassay

s.16(2)(c)

Thanks for this. I would ask that if we are to go ahead that one of you give [REDACTED] the heads up and let him know we will be contacting [REDACTED] to arrange for Thursday. As for the farms I believe Ross is now empty and Dixon is aggressively harvesting, not sure when harvest ends at Dixon and whether we can get lice while they are harvesting. So as far as who is left to get lice from I believe Bawden is the next candidate. We could look at Saranac and Rant but I don't know if they showed obvious failure in Krista's graphs.

I'm out in the field all day today but will look at data tonight, If you have time to pick a good candidate site that would be great, anyways keep me posted on whether it's a go or not.

Thanks

Howie

From: Waddington, Zac
Sent: May-29-18 4:34 AM
To: Keith, Ian
Cc: Manchester, Howie
Subject: RE: bioassay

[REDACTED] I am really curious for your opinion when/if [REDACTED] gets back to you with his bioassay results, and if you are satisfied with what he provides. I do not have a minimum testing standard in mind that would satisfy me, but my rationale was that if [REDACTED] provided good evidence of resistance then our own sampling wouldn't be necessary. My thoughts would be that if there's any doubt about whether [REDACTED] bioassay results show resistance, or is he doesn't get them to us in time, then we should just plan to collect our own samples. So at this point I would suggest that Howie and team plan to collect lice on Thursday from the most convenient site with a documented SLICE failure (as based on the graphs Krista generated). I'm not sure of the state of harvest at Ross and Dixon, but they both had quite high lice levels. Does that sound like a workable plan?

Zac

From: Keith, Ian
Sent: May-28-18 6:54 PM
To: Waddington, Zac
Cc: Manchester, Howie
Subject: bioassay

Hey,
[REDACTED] (I'm assuming the meeting is in Quebec.)
I had a response from [REDACTED] about missed fish health events but have had no email about bioassay results. Howie would like to know tomorrow if they are to go ahead on Thursday, so I can phone [REDACTED] tomorrow to ask about bioassays he will be sharing. Is there some minimum that would satisfy you, or is your wish to have our independently collected lice for our own data? I don't know how C&P advised you - [REDACTED]

Thanks
Ian

Ps: Howie was at Fortune today - [REDACTED] fish, March entry, and they are just exceeded threshold now. I'll ask [REDACTED] tomorrow what the plan is for these fish.

Pps: [REDACTED]
s.19(1)
s.20(1)(b)
s.21(1)(a)
s.21(1)(b)

Dr. Ian Keith DVM
Field Operations Veterinarian – Pacific Region
Fisheries and Oceans Canada | Pêches et Océans Canada
Fisheries Management
Aquaculture Management Division | Gestion de l'aquaculture
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#103 – 2435 Mansfield Drive
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Fax | Télécopieur: 250-703-0921
Ian.Keith@dfo-mpo.gc.ca

s.16(2)(c)

Paylor, Adrienne

From: Paylor, Adrienne
Sent: May-29-18 10:49 AM
To: Webb, Allison
Subject: FW: URGENT: sea lice media lines for approval - so sorry - need your help with this. My apologies, but please call me and I can type up.

Allison,



Thanks
Adrienne

From: Webb, Allison
Sent: Friday, May 04, 2018 5:09 PM
To: Paylor, Adrienne
Subject: RE: URGENT: sea lice media lines for approval - so sorry - need your help with this. My apologies, but please call me and I can type up.

Sounds good. I'm at my desk number below. Tx.

Allison Webb, Director / Directrice
Aquaculture Management / Gestion de l'aquaculture
Fisheries Management Branch / Direction de la gestion des pêches
Fisheries and Oceans Canada / Pêches et Océans Canada
200 - 401 Burrard St / Rue Burrard, Vancouver BC / C.B. V6C 3S4 Canada
604-666-7009
Allison.webb@dfo-mpo.gc.ca

From: Paylor, Adrienne
Sent: 2018-May-04 5:09 PM
To: Webb, Allison
Subject: Re: URGENT: sea lice media lines for approval - so sorry - need your help with this. My apologies, but please call me and I can type up.

Will call in 10min

Sent from my BlackBerry 10 smartphone on the Rogers network.

From: Webb, Allison
Sent: Friday, May 4, 2018 5:02 PM
To: Paylor, Adrienne
Subject: FW: URGENT: sea lice media lines for approval - so sorry - need your help with this. My apologies, but please call me and I can type up.

s.21(1)(b)

s.23

Allison Webb, Director / Directrice
Aquaculture Management / Gestion de l'aquaculture

Fisheries Management Branch / Direction de la gestion des pêches

Fisheries and Oceans Canada / Pêches et Océans Canada

200 - 401 Burrard St / Rue Burrard, Vancouver BC / C.B. V6C 3S4 Canada

604-666-7009

Allison.webb@dfo-mpo.gc.ca

From: Thomson, Andrew

Sent: 2018-May-04 4:35 PM

To: Webb, Allison

Subject: Fw: URGENT: sea lice media lines for approval

Will need to send an email to RDG on the issue as well. Can you do up a short summary of how bad the levels are and what's being done about it.

When did we post the sea lice numbers - is this something we should have flagged as likely to cause attention?

Andrew J L Thomson

Regional Director | Directeur Régionale

Fisheries Management Branch | Direction de la gestion des pêches

Pacific Region | Région du Pacifique

Fisheries & Oceans Canada | Pêches et Océans Canada

Suite 200 – 401 Burrard St.

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andrew.thomson@dfo-mpo.gc.ca

Telephone | Téléphone 604.666.0751

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Government of Canada | Gouvernement du Canada.

From: Rainer, Michelle <Michelle.Rainer@dfo-mpo.gc.ca>

Sent: Friday, May 4, 2018 4:27 PM

To: Thomson, Andrew

Cc: Bate, Dan; Girouard, Louise

Subject: URGENT: sea lice media lines for approval

Hi Andy,

Sorry for all the "urgents" today! Can you please review ASAP? Please cc Dan and Louise on response.

Thanks,

Michelle

Issue: [REDACTED] CBC Victoria [REDACTED]

Parksville Qualicum Beach News, ([REDACTED]) Looking for response on high levels of sea lice reported at Cermaq Canada farms in BC's Clayoquot area. See press release issued May 5 by Clayoquot Action Campaigns, provided below.

Deadline: Friday, May 5, 4:00 p.m. PST

Recommendation: email approved response

Approved by: Zac Waddington, Allison Webb, Claire Doucette

Media lines:

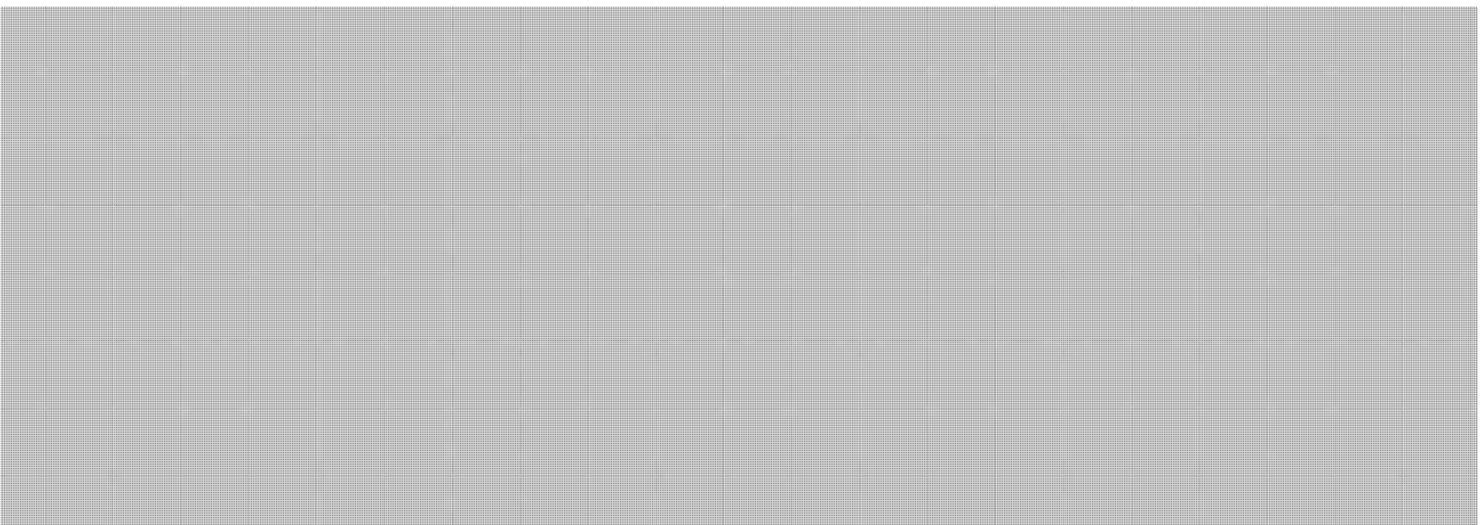
s.19(1)

- DFO is aware of the sea lice exceedances at Cermaq Canada's facilities in Clayoquot and has been in ongoing discussions with the company since January 2018 about measures to reduce sea lice levels.
- Under the Pacific Aquaculture Regulations, DFO requires salmon farming companies to regularly monitor and manage sea lice levels at their facilities in BC. DFO also regularly conducts assessments of sea lice abundance at these facilities.
- Companies in BC must submit a lice reduction plan if monitoring shows sea lice levels higher than three motile sea lice per farmed fish during the wild salmon outmigration period from March 1 to June 30 of each year. Motile lice are those at the free-moving stages of their life cycle.
- Salmon farming companies use an in-feed therapeutant called SLICE (emamectin benzoate) to reduce lice abundance. In cases where the use of SLICE does not result in adequate reduction of sea lice, companies can apply to the province of British Columbia for a permit to use alternative treatments, including Paramove (a hydrogen peroxide bath).
- Cermaq has applied for a permit but has not yet obtained one from the province of BC. Please contact Cermaq or the Province of BC's Ministry of Agriculture for further information on this process.
- Hydrogen peroxide is widely used around the world, including elsewhere on Canada's west coast, with excellent effect and no demonstrable effects to the ecosystem. This pesticide is not absorbed by the fish and is non-toxic to humans. It also dissipates as a neutralized substance quickly in the environment and causes no discernible far-field effect.
- DFO is investigating the management of lice at farms in Clayoquot by Cermaq Canada to determine if there has been non-compliance with the licence conditions and cannot comment further at this time.
- DFO makes reports on the numbers of sea lice at BC aquaculture farms available to the public at www.dfo-mpo.gc.ca/aquaculture/protect-protege/parasites-eng.html.

Available at <https://www.wildfirst.ca/clayoquot-action-salmon-lice-outbreak-could-devastate-clayoquot-salmon/>

FOR IMMEDIATE RELEASE:

Salmon lice outbreak could devastate Clayoquot salmon



s.68(a)



-30-

Clayoquot Action

High res photos of Clayoquot May 2018 juvenile salmon with lice and Cermaq salmon lice graphs available here:

<https://drive.google.com/drive/folders/1ps-GumjM4j7RmsYT-kVu1GjJR2oJltqz?usp=sharing>

Cermaq's public reporting webpage: <https://www.cermaq.com/wps/wcm/connect/cermaq-ca/cermaq-canada/our-promise/public-reporting/>

s.19(1)

s.68(a)

Paylor, Adrienne

From: Paylor, Adrienne
Sent: May-29-18 12:31 PM
To: Webb, Allison
Subject: RE: Info re sea lice for Rebecca

Yes thank you ☺

From: Webb, Allison
Sent: Tuesday, May 29, 2018 11:51 AM
To: Paylor, Adrienne
Subject: FW: Info re sea lice for Rebecca

Is this what you are looking for?

Allison Webb, Director / Directrice
Aquaculture Management / Gestion de l'aquaculture
Fisheries Management Branch / Direction de la gestion des pêches
Fisheries and Oceans Canada / Pêches et Océans Canada
200 - 401 Burrard St / Rue Burrard, Vancouver BC / C.B. V6C 3S4 Canada
604-666-7009
Allison.webb@dfo-mpo.gc.ca

From: Webb, Allison
Sent: 2018-May-04 6:20 PM
To: Thomson, Andrew
Subject: RE: Info re sea lice for Rebecca

Discussed it with Adrienne and she said we weren't able to move forward on the options proposed by Karen. I'll find out more later, [REDACTED]

Allison Webb, Director / Directrice
Aquaculture Management / Gestion de l'aquaculture
Fisheries Management Branch / Direction de la gestion des pêches
Fisheries and Oceans Canada / Pêches et Océans Canada
200 - 401 Burrard St / Rue Burrard, Vancouver BC / C.B. V6C 3S4 Canada
604-666-7009
Allison.webb@dfo-mpo.gc.ca

From: Thomson, Andrew
Sent: 2018-May-04 6:19 PM
To: Webb, Allison
Subject: Re: Info re sea lice for Rebecca

Thanks for the summary.

Last years exceedances in Esperanza prompted Karen Calla to look as to what regulatory changes we could make to strengthen our ability to enforce the CoL on sea lice actions. Might be worth talking to her about where those proposed changes went.

s.21(1)(a)

s.21(1)(b)

Andrew J L Thomson

Regional Director | Directeur Régionale
Fisheries Management Branch | Direction de la gestion des pêches
Pacific Region | Région du Pacifique
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andrew.thomson@dfo-mpo.gc.ca
Telephone | Téléphone 604.666.0751
Facsimile | Télécopieur 250.666.8069
Government of Canada | Gouvernement du Canada.

From: Webb, Allison
Sent: Friday, May 4, 2018 5:53 PM
To: Thomson, Andrew
Subject: Info re sea lice for Rebecca

DFO requires sea lice counts to be done on salmon as part of our regulatory management under the Conditions of Licence. This information is mandatorily reported to DFO and included in our public reports. There are established thresholds for sea lice counts (from Mar 1 – June 30 – salmon outmigration - it is no higher than 3 motile sea lice per farmed fish). DFO works with the companies to address any exceedances of these thresholds. In this case, DFO has been aware of this situation and working with Cermaq whose treatment has failed. Cermaq has applied to BC MOE to use an alternative treatment (hydrogen peroxide), but has had difficulty getting this approved. We believe that they just received a permit for one of the sites today. In the interim, Cermaq has been harvesting fish as is the typical approach in this situation.

DFO AMD staff conduct sea lice counts throughout the year and double the audit during the salmon outmigration period as part of our regulatory management of the industry. DFO staff confirmed exceedance of the sea lice thresholds for these farms and as above, have been working with Cermaq to address. We do not have any other regulatory tools to require action.

To put this in context, the highest lice loads in this area were 23 lice per fish (that site was harvested and no fish remain), and other sites varied as below (number from March counts)

Ross – 15
Miller – 23
Dixon – 9
Bawden – 9.7

These are at various stages of management. Last year, there were sites in Esperanza Inlet that recorded numbers of about 60 lice/fish (significantly higher). There were no media calls related to that data being posted.

This most recent data has been posted on line within the past two weeks (I have no way to verify the exact date at this time, but I approved some data on April 28th up to Dec 2017 at farm level data and on Mon April 30 the exceedance pie graphs by zone up to March 2018).

The public reports have been posted on our web pages for quite some time and numbers vary by year and time of year.

We are currently investigating this situation and can not comment further in the media regarding whether or not Cermaq has taken appropriate measures consistent with their Action Plan that has been discussed with DFO.

We can update you as further info is received. We are also working actively with the BC MOE to try to facilitate a speedier approval for permits to use hydrogen peroxide when SLICE resistance is demonstrated. We have a meeting scheduled for May 14, 2018. The tools in our toolbox are limited and we will need to work on this.

This has happened a few times before, but generally speaking compliance is good. We continue to follow this closely.

If you have any further questions, please let me know.

Thanks,
Allison

Media Lines attached with Media Release from Clayquot Action Campaigns below

Issue: [REDACTED] CBC Victoria [REDACTED]
Parksville Qualicum Beach News, [REDACTED] Looking for response on high levels of sea lice reported at Cermaq Canada farms in BC's Clayoquot area. See press release issued May 5 by Clayoquot Action Campaigns, provided below.

Deadline: Friday, May 5, 4:00 p.m. PST

Recommendation: email approved response

Approved by: Zac Waddington, Allison Webb, Claire Doucette

Media lines:

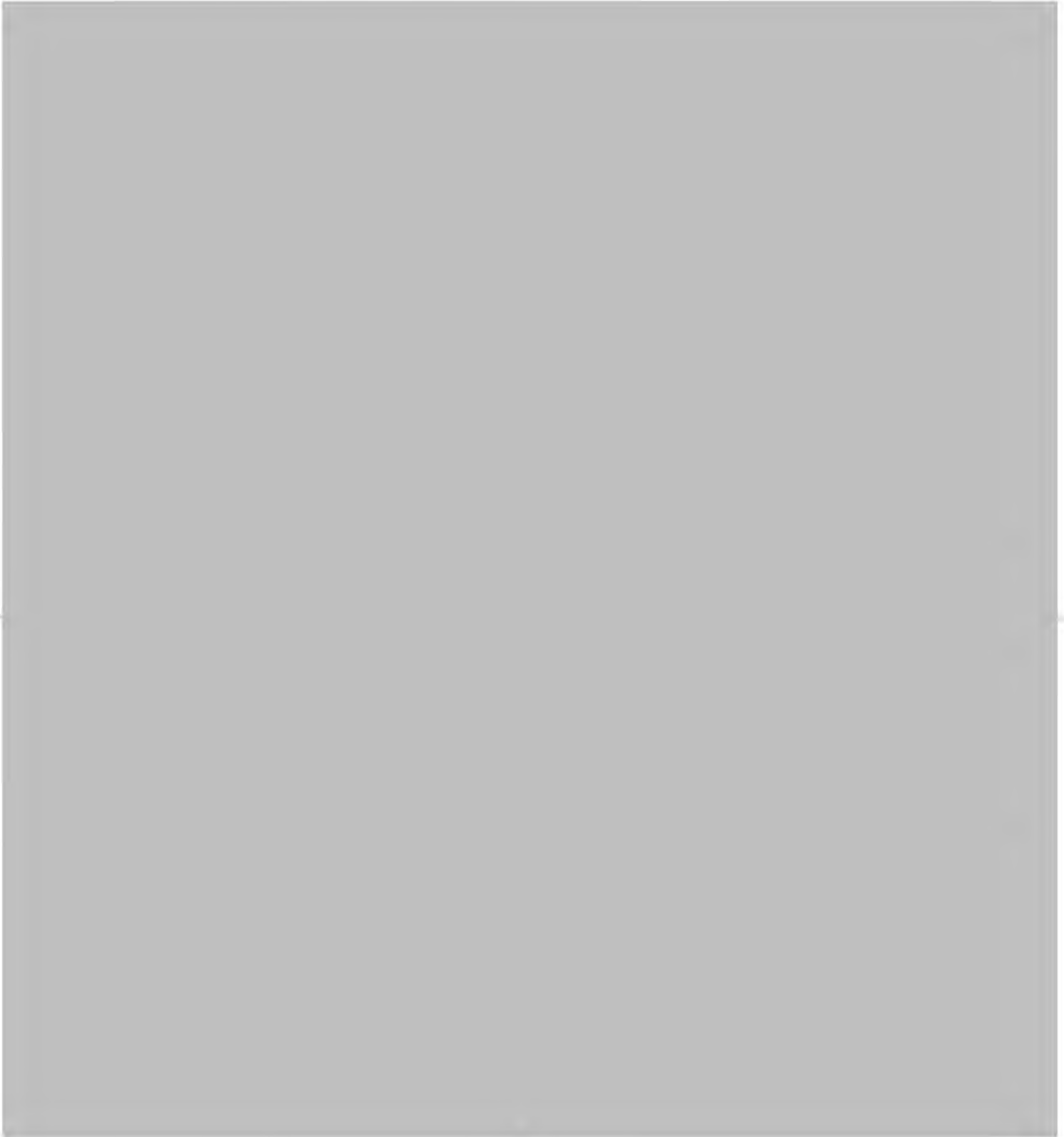
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s.19(1)

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FOR IMMEDIATE RELEASE:

Salmon lice outbreak could devastate Clayoquot salmon



-30-

Clayoquot Action

High res photos of Clayoquot May 2018 juvenile salmon with lice and Cermaq salmon lice graphs available here:

<https://drive.google.com/drive/folders/1ps-GumjM4j7RmsYT-kVu1GjJR2ojltqz?usp=sharing>

Cermaq's public reporting webpage: <https://www.cermaq.com/wps/wcm/connect/cermaq-ca/cermaq-canada/our-promise/public-reporting/>

s.19(1)

s.68(a)

Sandberg, Krista

From: Sandberg, Krista
Sent: May-29-18 12:44 PM
To: Waddington, Zac; Manchester, Howie; Keith, Ian
Subject: RE: bioassay

Hey guys, I've updated all the graphs to include April data, including addition of harvest plans to the harvesting graph.
Enjoy ☺

\\svbcvanfp01\aquas\AEO\Courtenay\FH\sea lice management\Sea Lice - Clayoquot graphs 2017.xls

Krista Sandberg

Office | Bureau 250-286-5835

Cellular | Cellulaire [REDACTED]



Government
of Canada

Gouvernement
du Canada

Canada

From: Waddington, Zac
Sent: May-29-18 9:26 AM
To: Sandberg, Krista; Manchester, Howie; Keith, Ian
Subject: Re: bioassay

Thanks a bunch Krista. I know your super busy, but is there anyway you could generate the "absolute sea lice inventory" graph for sites using the April lice and inventory data as was done for March? It'll be important for C and P, I'm expecting to have a meeting with them later this week at some point.

Zac

From: Sandberg, Krista
Sent: Tuesday, May 29, 2018 11:16 AM
To: Manchester, Howie; Waddington, Zac; Keith, Ian
Subject: RE: bioassay

I updated the inventory files yesterday. Miller and Ross are empty, and it looks like they are currently harvesting from Mussel and Saranac with plans to empty Dixon in June.

Krista.

Krista Sandberg

Office | Bureau 250-286-5835

Cellular | Cellulaire [REDACTED]



Government
of Canada

Gouvernement
du Canada

Canada

From: Manchester, Howie
Sent: May-29-18 7:09 AM
To: Waddington, Zac; Keith, Ian
Cc: Sandberg, Krista
Subject: RE: bioassay

s.16(2)(c)

Thanks for this. I would ask that if we are to go ahead that one of you give [REDACTED] the heads up and let him know we will be contacting [REDACTED] to arrange for Thursday. As for the farms I believe Ross is now empty and Dixon is aggressively harvesting, not sure when harvest ends at Dixon and whether we can get lice while they are harvesting. So as far as who is left to get lice from I believe Bawden is the next candidate. We could look at Saranac and Rant but I don't know if they showed obvious failure in Krista's graphs.

I'm out in the field all day today but will look at data tonight, If you have time to pick a good candidate site that would be great, anyways keep me posted on whether it's a go or not.

Thanks

Howie

From: Waddington, Zac
Sent: May-29-18 4:34 AM
To: Keith, Ian
Cc: Manchester, Howie
Subject: RE: bioassay

[REDACTED]
[REDACTED] I am really curious for your opinion when/if [REDACTED] gets back to you with his bioassay results, and if you are satisfied with what he provides. I do not have a minimum testing standard in mind that would satisfy me, but my rationale was that if [REDACTED] provided good evidence of resistance then our own sampling wouldn't be necessary. My thoughts would be that if there's any doubt about whether [REDACTED] bioassay results show resistance, or is he doesn't get them to us in time, then we should just plan to collect our own samples. So at this point I would suggest that Howie and team plan to collect lice on Thursday from the most convenient site with a documented SLICE failure (as based on the graphs Krista generated). I'm not sure of the state of harvest at Ross and Dixon, but they both had quite high lice levels. Does that sound like a workable plan?

Zac

From: Keith, Ian
Sent: May-28-18 6:54 PM
To: Waddington, Zac
Cc: Manchester, Howie
Subject: bioassay

s.19(1)
s.20(1)(b)
s.21(1)(a)
s.21(1)(b)

Hey,

[REDACTED] (I'm assuming the meeting is in Quebec.)

I had a response [REDACTED] about missed fish health events but have had no email about bioassay results.

Howie would like to know tomorrow if they are to go ahead on Thursday, so I can phone [REDACTED] tomorrow to ask about bioassays he will be sharing. Is there some minimum that would satisfy you, or is your wish to have our independently collected lice for our own data? I don't know how C&P advised you – [REDACTED]

Thanks

Ian

P.s: Howie was at Fortune today – [REDACTED] fish, March entry, and they are just exceeded threshold now. I'll ask [REDACTED] tomorrow what the plan is for these fish.

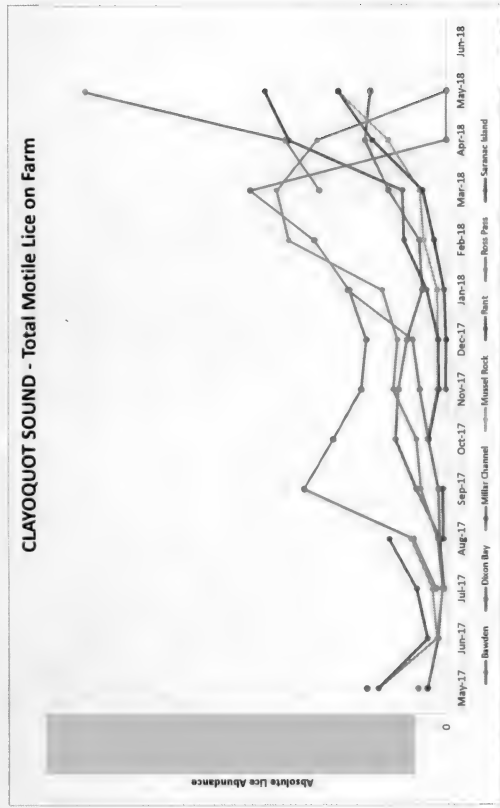
Pps: [REDACTED]

Dr. Ian Keith DVM
Field Operations Veterinarian – Pacific Region
Fisheries and Oceans Canada | Pêches et Océans Canada
Fisheries Management
Aquaculture Management Division | Gestion de l'aquaculture
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Ian.Keith@dfo-mpo.gc.ca

s.16(2)(c)

<i>Facility Name</i>	<i>Product</i>	<i>Treatment Start Date</i>	<i>Treatment End Date</i>
Bawden Point, Herbert Inlet	Slice	06-Jun-17	14-Jun-17
Dixon Point, Shelter Inlet	Slice	09-Jun-17	15-Jun-17
Dixon Point, Shelter Inlet	Slice	05-Oct-17	11-Oct-17
Fortune Channel, East side Warn Bay	Slice	12-Feb-17	18-Feb-17
Millar Channel, 2km S Hayden Passage	Slice	02-Jun-17	08-Jun-17
Millar Channel, 2km S Hayden Passage	Slice	21-Sep-17	27-Sep-17
Mussel Rock, Clayoquot Sound	Slice	19-May-17	25-May-17
Mussel Rock, Clayoquot Sound	Slice	24-Sep-17	30-Sep-17
Rant Point, Clayoquot Sound	Slice	24-May-17	03-Jun-17
Rant Point, Clayoquot Sound	Slice	29-Sep-17	05-Oct-17
Raza Island, Raza Passage	Slice	25-Jan-17	31-Jan-17
Raza Island, Raza Passage	Slice	16-Jan-17	22-Jan-17
Ross Pass, Northeast McKay Island	Slice	02-Jun-17	09-Jun-17
Ross Pass, Northeast McKay Island	Slice	01-Oct-17	07-Oct-17
Saranac Island, NW of Meares Island	Slice	13-May-17	19-May-17
Saranac Island, NW of Meares Island	Slice	16-Sep-17	23-Sep-17
West Side, Bedwell Sound	Slice	05-Feb-17	11-Feb-17
Plover	Paramove	07-Jun-18	
Bawden Point, Herbert Inlet	Paramove	11-Jun-18	
Bare Bluff	Paramove	24-Jun-18	
Fortune Channel, East side Warn Bay	Paramove	08-Jul-18	
Bedwell	Paramove	02-Jul-18	

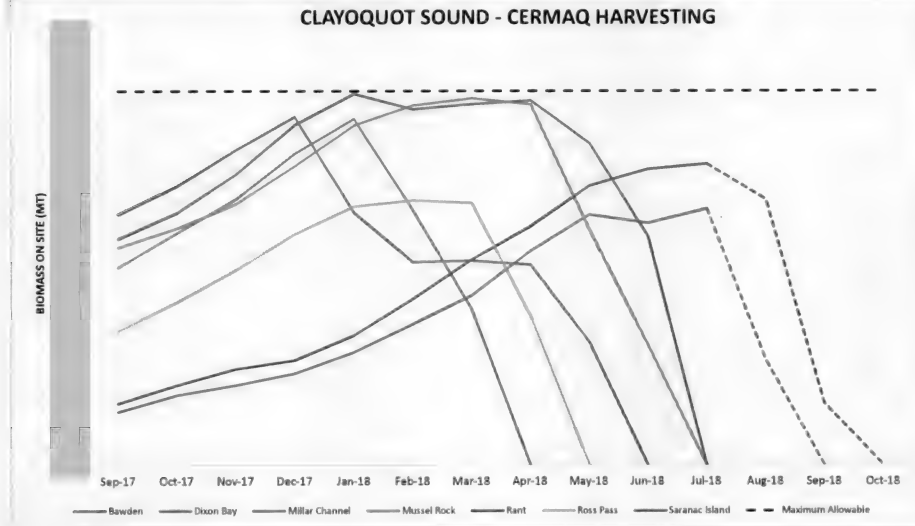
	End of Month Inventory											
	May-17	Jun-17	Jul-17	Aug-17	Sep-17	Oct-17	Nov-17	Dec-17	Jan-18	Feb-18	Mar-18	Apr-18
Bawden												
Dixon Bay												
Miller Channel												
Mussel Rock												
Rant												
Ross Pass												
Saranac Island												
Mid-Month Inventory												
May-17	Jun-17	Jul-17	Aug-17	Sep-17	Oct-17	Nov-17	Dec-17	Jan-18	Feb-18	Mar-18	Apr-18	May-18
Bawden												
Dixon Bay												
Miller Channel												
Mussel Rock												
Rant												
Ross Pass												
Saranac Island												
Average Motile Abundance												
May-17	Jun-17	Jul-17	Aug-17	Sep-17	Oct-17	Nov-17	Dec-17	Jan-18	Feb-18	Mar-18	Apr-18	May-18
Bawden	1.85	0.18	0.50	0.62	1.37	2.04	2.59	7.53	9.77	12.43	28.05	17.09
Dixon Bay	1.34	0.60	0.33	0.48	2.14	3.62	3.42	2.11	3.43	9.08	13.92	17.09
Miller Channel	4.92	0.68	2.11	8.96	7.17	5.43	5.11	6.20	10.07	23.55	1.75	4.26
Mussel Rock	1.26	0.55	0.81	2.07	1.14	0.54	0.52	0.57	1.39	1.75	4.26	10.36
Rant	4.92	0.72	0.30	0.26	0.30	2.37	4.17	3.86	5.06	12.70	15.14	25.08
Ross Pass	3.93	1.12	1.74	3.34	1.07	0.47	0.50	1.19	2.65	3.17	12.87	16.49
Saranac Island												
Total # Lice on Farm												
May-17	Jun-17	Jul-17	Aug-17	Sep-17	Oct-17	Nov-17	Dec-17	Jan-18	Feb-18	Mar-18	Apr-18	May-18
Bawden												
Dixon Bay												
Miller Channel												
Mussel Rock												
Rant												
Ross Pass												
Saranac Island												



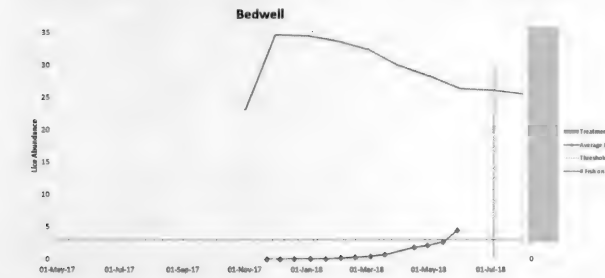
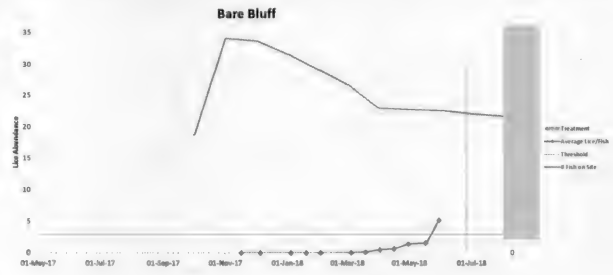
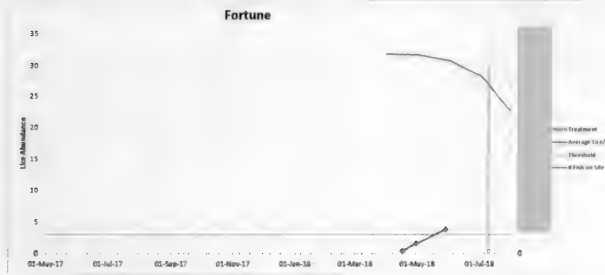
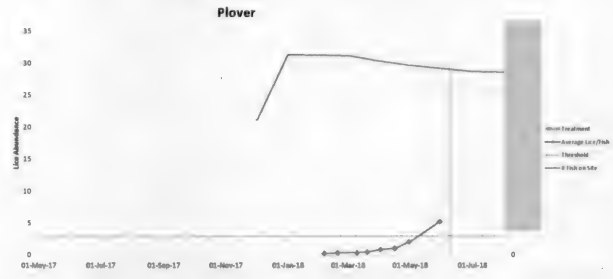
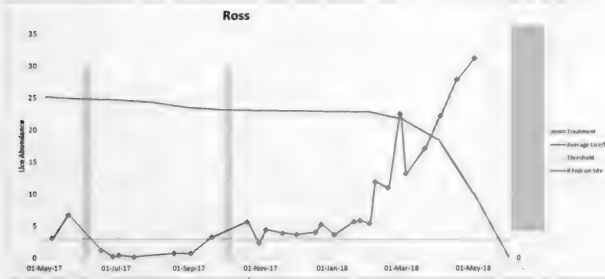
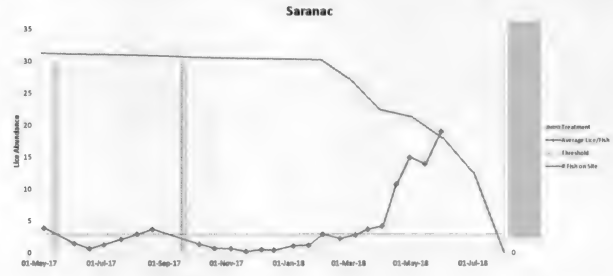
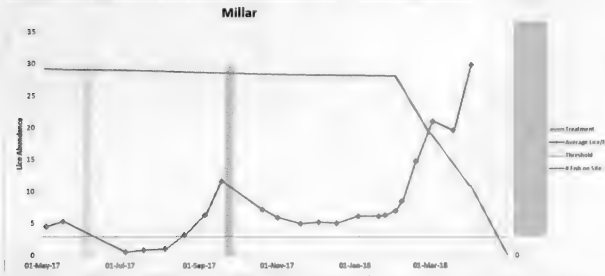
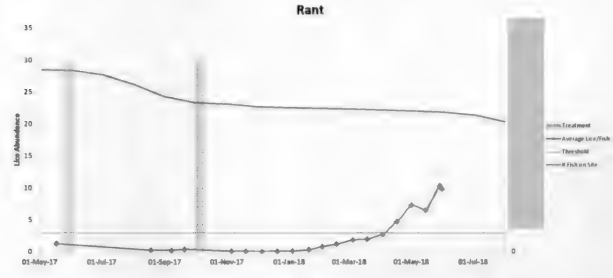
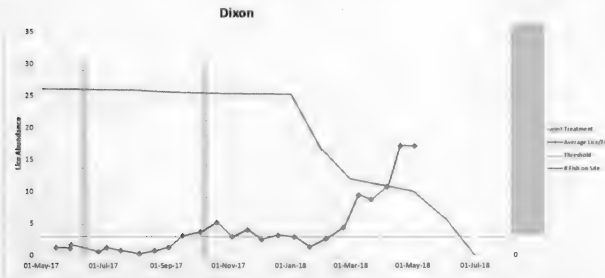
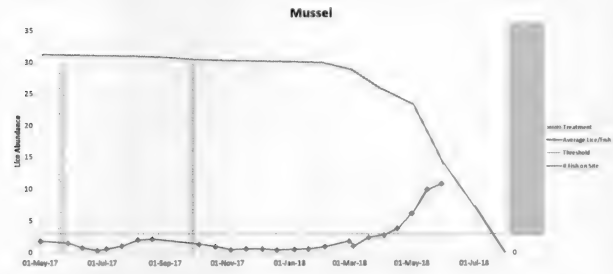
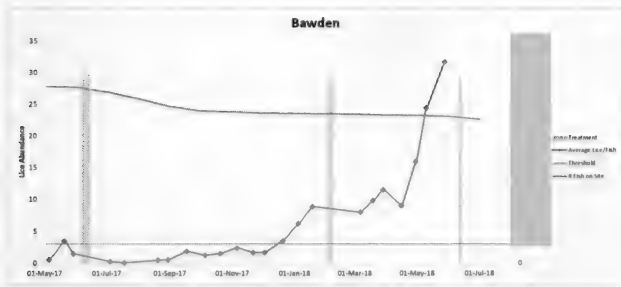
s.20(1)(b)

No info severed here

	Actual											Predicted			
	Sep-17	Oct-17	Nov-17	Dec-17	Jan-18	Feb-18	Mar-18	Apr-18	May-18	Jun-18	Jul-18	Aug-18	Sep-18	Oct-18	
Bawden	374	493	562	646	796	996	1196	1511	1768	1708	1808				
Dixon Bay	1769	1968	2222	2456	1784	1434	1444	1413	868	0					
Millar Channel	1395	1638	1873	2198	2443	1802	1102	0							
Mussel Rock	1536	1673	1843	2111	2397	2537	2587	2545	1662	849	0				
Rant	434	562	678	739	915	1171	1451	1684	1972	2089	2126				
Ross Pass	945	1150	1373	1628	1824	1867	1849	1052	0						
Saranac Island	1598	1780	2050	2399	2619	2509	2546	2572	2270	1614	0				
Maximum Allowable	2640	2640	2640	2640	2640	2640	2640	2640	2640	2640	2640	2640	2640	2640	
Bawden - predicted												1808	741	0	
Dixon Bay - predicted															
Millar Channel - predicted															
Mussel Rock - predicted															
Rant - predicted												2126	1873	436	0
Ross Pass - predicted															
Saranac Island - predicted															



s.20(1)(b)



s.20(1)(b)

Manchester, Howie

From: Waddington, Zac
Sent: May-29-18 2:15 PM
To: Manchester, Howie
Cc: Keith, Ian; Paylor, Adrienne
Subject: RE: bioassay

In chatting with Ian, we have agreed that Bawden would be the best site to grab lice from, unless there is some logistical issue with that which makes it impossible. Ian is chatting [REDACTED] to give him the heads up of our plans, and we were hoping that you guys would be able to arrange things directly with the site? So regardless of what [REDACTED] comes back with for bioassay data, we believe that this is an opportunity for data collection which shouldn't be missed. Thanks again!

Zac

From: Manchester, Howie
Sent: May-29-18 7:09 AM
To: Waddington, Zac; Keith, Ian
Cc: Sandberg, Krista
Subject: RE: bioassay

Thanks for this. I would ask that if we are to go ahead that one of you give [REDACTED] the heads up and let him know we will be contacting [REDACTED] to arrange for Thursday. As for the farms I believe Ross is now empty and Dixon is aggressively harvesting, not sure when harvest ends at Dixon and whether we can get lice while they are harvesting. So as far as who is left to get lice from I believe Bawden is the next candidate. We could look at Saranac and Rant but I don't know if they showed obvious failure in Krista's graphs.

I'm out in the field all day today but will look at data tonight, If you have time to pick a good candidate site that would be great, anyways keep me posted on whether it's a go or not.

Thanks

Howie

From: Waddington, Zac
Sent: May-29-18 4:34 AM
To: Keith, Ian
Cc: Manchester, Howie
Subject: RE: bioassay

[REDACTED]

I am really curious for your opinion when/if [REDACTED] gets back to you with his bioassay results, and if you are satisfied with what he provides. I do not have a minimum testing standard in mind that would satisfy me, but my rationale was that if [REDACTED] provided good evidence of resistance then our own sampling wouldn't be necessary. My thoughts would be that if there's any doubt about whether [REDACTED] bioassay results show resistance, or is he doesn't get them to us in time, then we should just plan to collect our own samples. So at this point I would suggest that Howie and team plan to collect lice on Thursday from the most convenient site with a documented SLICE failure (as based on the graphs Krista generated). I'm not sure of the state of harvest at Ross and Dixon, but they both had quite high lice levels. Does that sound like a workable plan?

Zac

From: Keith, Ian
Sent: May-28-18 6:54 PM
To: Waddington, Zac
Cc: Manchester, Howie
Subject: bioassay

Hey,

(I'm assuming the meeting is in Quebec.)

I had a response [REDACTED] about missed fish health events but have had no email about bioassay results.

Howie would like to know tomorrow if they are to go ahead on Thursday, so I can phone [REDACTED] tomorrow to ask about bioassays he will be sharing. Is there some minimum that would satisfy you, or is your wish to have our independently collected lice for our own data? I don't know how C&P advised you – [REDACTED]

Thanks

Ian

Pps: Howie was at Fortune today – [REDACTED] fish, March entry, and they are just exceeded threshold now. I'll ask [REDACTED] tomorrow what the plan is for these fish.

Pps: [REDACTED]

Dr. Ian Keith DVM
Field Operations Veterinarian – Pacific Region
Fisheries and Oceans Canada | Pêches et Océans Canada
Fisheries Management
Aquaculture Management Division | Gestion de l'aquaculture
Aquaculture Environmental Operations – Fish Health
#103 – 2435 Mansfield Drive
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Mobile | Portable: [REDACTED]
Fax | Télécopieur: 250-703-0921
Ian.Keith@dfo-mpo.gc.ca

s.16(2)(c)

s.19(1)

s.20(1)(b)

s.21(1)(a)

s.21(1)(b)

Waddington, Zac

From: Waddington, Zac
Sent: May-29-18 2:17 PM
To: Sandberg, Krista; Manchester, Howie; Keith, Ian
Subject: RE: bioassay

Hooray! Thanks so much Krista for getting that our so quickly.

Zac

From: Sandberg, Krista
Sent: May-29-18 12:44 PM
To: Waddington, Zac; Manchester, Howie; Keith, Ian
Subject: RE: bioassay

Hey guys, I've updated all the graphs to include April data, including addition of harvest plans to the harvesting graph.
Enjoy ☺

\\svbcvanfp01\aquas\AEO\Courtenay\FH\sea lice management\Sea Lice - Clayoquot graphs 2017.xls

Krista Sandberg
Office | Bureau 250-286-5835
Cellular | Cellulaire [REDACTED]



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du Canada

Canada

From: Waddington, Zac
Sent: May-29-18 9:26 AM
To: Sandberg, Krista; Manchester, Howie; Keith, Ian
Subject: Re: bioassay

Thanks a bunch Krista. I know your super busy, but is there anyway you could generate the "absolute sea lice inventory" graph for sites using the April lice and inventory data as was done for March? It'll be important for C and P, I'm expecting to have a meeting with them later this week at some point.

Zac

From: Sandberg, Krista
Sent: Tuesday, May 29, 2018 11:16 AM
To: Manchester, Howie; Waddington, Zac; Keith, Ian
Subject: RE: bioassay

I updated the inventory files yesterday. Miller and Ross are empty, and it looks like they are currently harvesting from Mussel and Saranac with plans to empty Dixon in June.

Krista.

s.16(2)(c)

Krista Sandberg
Office | Bureau 250-286-5835

Cellular | Cellulaire [REDACTED]



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du Canada

Canada

From: Manchester, Howie
Sent: May-29-18 7:09 AM
To: Waddington, Zac; Keith, Ian
Cc: Sandberg, Krista
Subject: RE: bioassay

Thanks for this. I would ask that if we are to go ahead that one of you give [REDACTED] the heads up and let him know we will be contacting [REDACTED] to arrange for Thursday. As for the farms I believe Ross is now empty and Dixon is aggressively harvesting, not sure when harvest ends at Dixon and whether we can get lice while they are harvesting. So as far as who is left to get lice from I believe Bawden is the next candidate. We could look at Saranac and Rant but I don't know if they showed obvious failure in Krista's graphs.

I'm out in the field all day today but will look at data tonight, If you have time to pick a good candidate site that would be great, anyways keep me posted on whether it's a go or not.

Thanks

Howie

From: Waddington, Zac
Sent: May-29-18 4:34 AM
To: Keith, Ian
Cc: Manchester, Howie
Subject: RE: bioassay

[REDACTED]
[REDACTED] I am really curious for your opinion when/if [REDACTED] gets back to you with his bioassay results, and if you are satisfied with what he provides. I do not have a minimum testing standard in mind that would satisfy me, but my rationale was that if [REDACTED] provided good evidence of resistance then our own sampling wouldn't be necessary. My thoughts would be that if there's any doubt about whether [REDACTED] bioassay results show resistance, or is he doesn't get them to us in time, then we should just plan to collect our own samples. So at this point I would suggest that Howie and team plan to collect lice on Thursday from the most convenient site with a documented SLICE failure (as based on the graphs Krista generated). I'm not sure of the state of harvest at Ross and Dixon, but they both had quite high lice levels. Does that sound like a workable plan?

Zac

From: Keith, Ian
Sent: May-28-18 6:54 PM
To: Waddington, Zac
Cc: Manchester, Howie
Subject: bioassay

Hey,
[REDACTED] (I'm assuming the meeting is in Quebec.)
I had a response [REDACTED] about missed fish health events but have had no email about bioassay results. Howie would like to know tomorrow if they are to go ahead on Thursday, so I can phone [REDACTED] tomorrow to ask about bioassays he will be sharing. Is there some minimum that would satisfy you, or is your wish to have our independently

collected lice for our own data? I don't know how C&P advised you – [REDACTED]

Thanks

Ian

Ps: Howie was at Fortune today – [REDACTED] fish, March entry, and they are just exceeded threshold now. I'll ask [REDACTED] tomorrow what the plan is for these fish.

Pps: [REDACTED]

Dr. Ian Keith DVM
Field Operations Veterinarian – Pacific Region
Fisheries and Oceans Canada | Pêches et Océans Canada
Fisheries Management
Aquaculture Management Division | Gestion de l'aquaculture
Aquaculture Environmental Operations – Fish Health
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Mobile | Portable: [REDACTED]
Fax | Télécopieur: 250-703-0921
Ian.Keith@dfo-mpo.gc.ca

s.16(2)(c)

s.19(1)

s.20(1)(b)

s.21(1)(a)

s.21(1)(b)

Paylor, Adrienne

From: Paylor, Adrienne
Sent: May-29-18 4:56 PM
To: Doucette, Claire
Cc: Waddington, Zac
Subject: [REDACTED]
Attachments: [REDACTED]

Hi Claire,

[REDACTED]

Thx Adrienne

From: Waddington, Zac
Sent: Tuesday, May 29, 2018 11:55 AM
To: Paylor, Adrienne
Subject: [REDACTED]

[REDACTED]

Zac

From: Paylor, Adrienne
Sent: May-29-18 10:17 AM
To: Waddington, Zac
Subject: [REDACTED]

Hi Zac,

[REDACTED]

Thanks
Adrienne

From: Doucette, Claire
Sent: Tuesday, May 29, 2018 10:04 AM
To: Paylor, Adrienne
Subject: [REDACTED]

Adrienne, [REDACTED]

[REDACTED]

s.21(1)(a)

s.21(1)(b)

s.23

Claire

From: Steele, Sharon <Sharon.Steele@ppsc-sppc.gc.ca>

Sent: Monday, May 28, 2018 4:16 PM

To: Doucette, Claire <Claire.Doucette@dfo-mpo.gc.ca>

Cc: Walde, Kirsty <Kirsty.Walde@dfo-mpo.gc.ca>; Knight, Joe <Joe.Knight@dfo-mpo.gc.ca>; Paylor, Adrienne <Adrienne.Paylor@dfo-mpo.gc.ca>; Gray, Trevor <Trevor.Gray@dfo-mpo.gc.ca>; Lohrasb, Katie <Katie.Lohrasb@ppsc-sppc.gc.ca>; Torvik, Kendra <Kendra.Torvik@ppsc-sppc.gc.ca>

Subject: [REDACTED]

Hi Claire,

[REDACTED]

[REDACTED]

Sharon

Sharon Steele
Senior Counsel/Team Leader
Supreme Court and Regulatory Litigation

Public Prosecution Service of Canada
British Columbia Regional Office
900 - 840 Howe Street
Vancouver, BC V6Z 2S9

Phone: 604.666.8916
Fax: 604.666.1599

s.21(1)(a)

s.21(1)(b)

s.23

**Pages 680 to / à 681
are withheld pursuant to section
sont retenues en vertu de l'article**

23

**of the Access to Information Act
de la Loi sur l'accès à l'information**

Keith, Ian

From: [REDACTED]
Sent: May-29-18 8:43 PM
To: Waddington, Zac; Keith, Ian
Cc: [REDACTED]
Subject: tofino lice information update
Attachments: may 28 18.pdf

Hi - see attached regarding your questions re Saranac and bioassays. [REDACTED]

[REDACTED]

CERMAQ

Phone +1 250-286-0022
Direct +1 250-286-0022 ext [REDACTED]
Mobile [REDACTED]

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s.19(1)

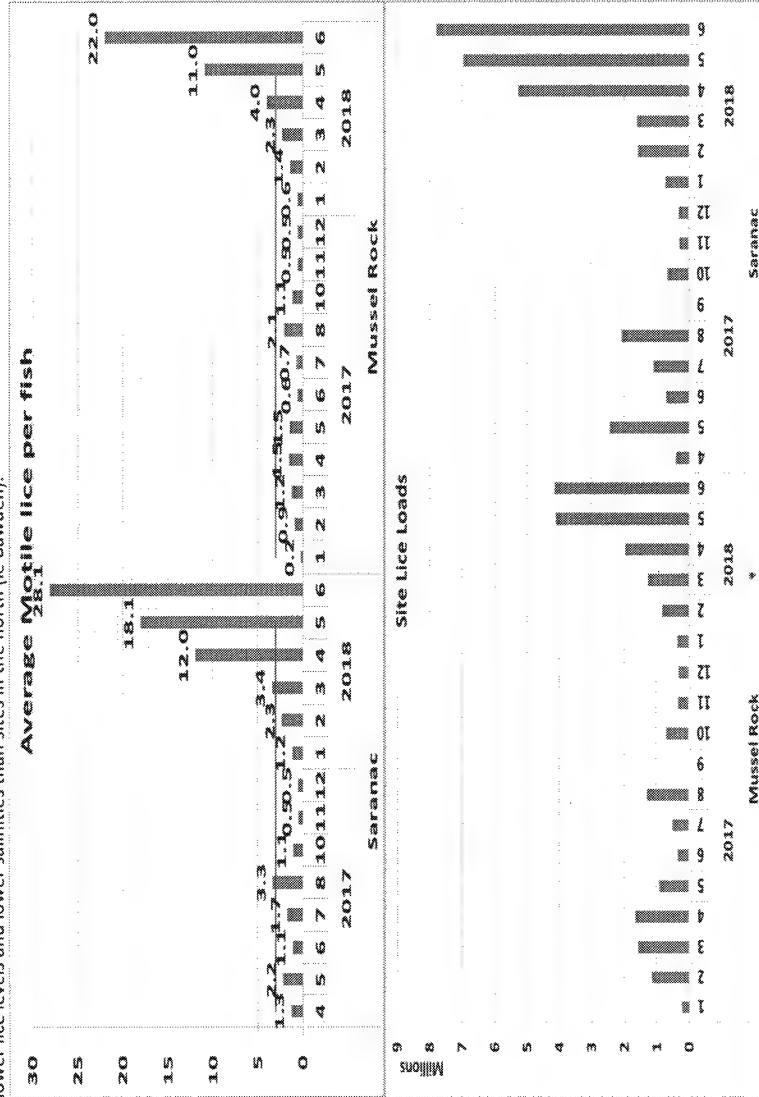
See attached additional information for motile lice levels by site (Mussel, Saranac), sea lice load by site (Mussel, Saranac), and total lice load combined for the 5 harvest size farms in Tofino (Millar, Ross, Dixon information provided previously). May and June as with previous communication are estimated based on harvest plan and continued lice level increases of 2.5 motile lice / fish per week for those fish remaining.

Note lice levels (both average and site loading) for Mussel and Saranac increased later in 2018 than Millar, Ross, and Dixon. Harvesting of both Mussel and Saranac has been consistent since the end of February with over 141,000 pieces harvested from Mussel and 223,000 pieces harvested from Saranac. Up till now harvesting in Tofino has been maximized and focused on those sites with the higher lice levels (Millar, Ross, Dixon). Millar was harvested out in April. Ross is now harvested out. Dixon is due to be harvested out June 14th. Although the lice loading at Mussel and Saranac has increased and is expected to continue to increase into June the overall lice load when considering the 5 harvest sites has continued to decrease and is expected to continue to do so.

As mentioned previously all considerations around additional harvesting and treatment options also apply to Mussel and Saranac. The only difference is that an additional 160,000 fish from Mussel will be processed at an external processing plant between May 13th and June 3rd to help reduce overall lice loads in Tofino.

Bioassay results in Tofino up until September of 2017 have not shown consistently high levels of resistance to Enamectin Benzoate in lice samples. The most recent results from Millar, Ross, and Saranac clearly show resistance to EB.

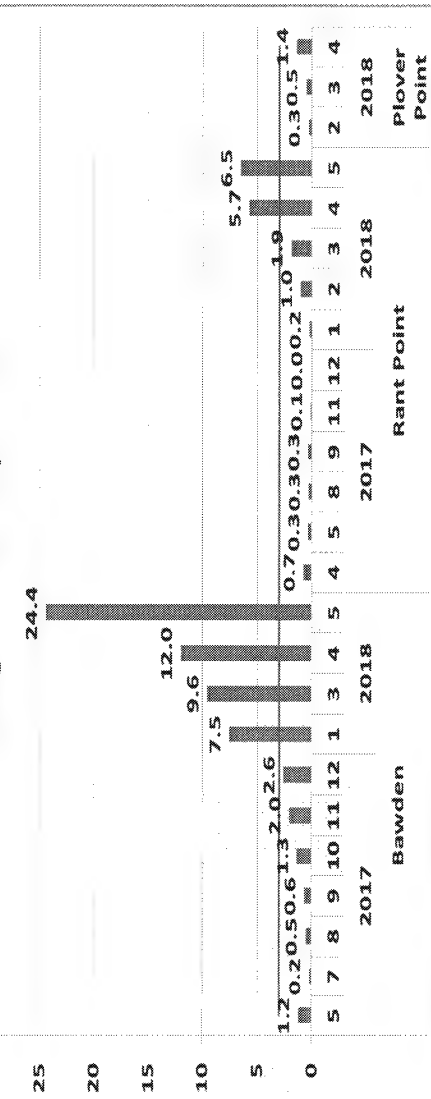
Peroxide treatments are planned to begin June 7th and continue for one month. Our intention is to treat three sites including Bawden (17YC), Rant (17YC), and Plover (18YC). See final graph on lice levels at those three sites. The treatment in February at Bawden did not have the desired impact on lice levels. Given similar bioassay results at Rant and the close proximity to Saranac and Mussel treatment at Rant was not undertaken. Sites in the south (ie Rant) characteristically have lower lice levels and lower salinities than sites in the north (ie Bawden).



Total Site Lice Loads - Millar, Dixon, Ross, Saranac, and Mussel Combined



Average Motile lice per fish



Waddington, Zac

From: Waddington, Zac
Sent: May-30-18 6:27 AM
To: 'bkoop@uvic.ca'
Cc: Keith, Ian
Subject: Lice Resistance

I am the new aquaculture veterinarian with DFO. I actually am currently at the AAC and saw your presentation on the salmon genome project which I found extremely interesting. You may or may not be aware of the current state of sea lice in Clayoquot, but essentially there has been widespread EB resistance and resulting extremely high lice levels on farm. Currently our field staff are in Clayoquot doing routine farm audits, and our plan was to collect lice for our own bioassay. However, [REDACTED] has shared his bioassay data with us as of yesterday, and has done numerous assays and quite recently, so our additional bioassay wouldn't really add much to the picture that we now have. That said, I am aware that you have done work on the genetic basis for EB resistance in sea lice, and I'm wondering if having lice samples from an area with known resistance would be useful to you? We currently have the equipment and plan in place to collect lice on Thursday morning in Clayoquot, but unless this sample could be of use to you I'm thinking we will pull the plug on this plan.

Dr. Zac Waddington DVM, B.Env.Sc.(Hons)
Lead Veterinarian - Pacific Region
Fisheries and Oceans Canada | Pêches et Océans Canada
Aquaculture Environmental Operations - Fish Health
Courtenay, British Columbia
Telephone | Téléphone: 250-703-0902
Fax | Télécopieur: 250-703-0921
Zac.Waddington@dfo-mpo.gc.ca

s.19(1)

Diamond, Maria

From: Manchester, Howie
Sent: 2018-May-30 10:57 AM
To: Diamond, Maria
Subject: Re: Tuesday afternoon

Please confer with Ian as I'm still not sure if this is a go or not.

Howie

Sent from my BlackBerry 10 smartphone on the Bell network.

From: Diamond, Maria
Sent: Wednesday, May 30, 2018 10:54
To: Manchester, Howie
Subject: RE: Tuesday afternoon

No problem I'll let [REDACTED] know.

[REDACTED]

Maria

From: Manchester, Howie
Sent: 2018-May-29 10:10 PM
To: Diamond, Maria
Subject: RE: Tuesday afternoon

Okay, thanks for letting me know.

Looks like we will be doing the bioassay on Thursday, so could you please coordinate with Ian and one of you let [REDACTED] know by noon tomorrow; let her know that there is still a chance it won't happen but we are planning on collecting the lice at this time.

[REDACTED]

Thanks

Howie

s.19(1)

From: Diamond, Maria
Sent: May-29-18 1:42 PM
To: Manchester, Howie
Subject: Tuesday afternoon

Hey Howie,

[REDACTED]

Will be in the office tomorrow.

Maria

p.s. I've officially passed on the SPOT/check-in duties to Ian.

Maria Diamond, B.Sc.

Aquatic Science Biologist / Biologiste en sciences aquatiques

Aquaculture Management Division / Gestion de l'aquaculture

Aquaculture Environmental Operations/Opérations environnementales de l'aquaculture

Fisheries and Oceans Canada / Pêches et Océans Canada

#103 - 2435 Mansfield Drive

Courtenay, B.C

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Fax: 250 703 0921



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du Canada

Canada

Diamond, Maria

From: Keith, Ian
Sent: 2018-May-31 6:01 PM
To: Waddington, Zac
Cc: Manchester, Howie; Charbonneau, Michelle; Diamond, Maria; Sandberg, Krista; Stenhouse, Shawn
Subject: recent paper
Attachments: A-200K-SNP-chip-reveals-a-novel-Pacific-salmon-louse-genotype-linked-to-differential-efficacy-of-emamectin-benzoate.pdf

These great samples today will help refine this paper.

Ian



Contents lists available at ScienceDirect

Marine Genomics

journal homepage: www.elsevier.com/locate/margen



Method paper

A 200K SNP chip reveals a novel Pacific salmon louse genotype linked to differential efficacy of emamectin benzoate

Amber M. Messmer^{a,1}, Jong S. Leong^{a,1}, Eric B. Rondeau^{a,1}, Anita Mueller^a, Cody A. Despains^a, David R. Minkley^a, Matthew P. Kent^b, Sigbjørn Lien^b, Brad Boyce^c, Diane Morrison^c, Mark D. Fast^d, Joseph D. Norman^{e,f}, Roy G. Danzmann^e, Ben F. Koop^{a,g,*,1}

^a Department of Biology, University of Victoria, Victoria V8W 2Y2, BC, Canada

^b Centre for Integrative Genetics (CIGENE), Department of Animal and Aquacultural Sciences, Norwegian University of Life Sciences, Ås, Norway

^c Marine Harvest Canada, Campbell River, BC, Canada

^d Department of Pathology and Microbiology, University of Prince Edward Island, Charlottetown, PEI C1A 4P3, Canada

^e Department of Integrative Biology, University of Guelph, Guelph, ON N1G 2W1, Canada

^f Present address: The Hospital for Sick Children, 686 Bay St., Toronto, ON M5G 0A4, Canada

^g Centre for Biomedical Research, University of Victoria, Victoria, BC V8W 3N5, Canada

ARTICLE INFO

Keywords:

Sea lice
Lepeophtheirus salmonis
EMB
SLICE
Resistance
Salmon farm

ABSTRACT

Antiparasitic drugs such as emamectin benzoate (EMB) are relied upon to reduce the parasite load, particularly of the sea louse *Lepeophtheirus salmonis*, on farmed salmon. The decline in EMB treatment efficacy for this purpose is an important issue for salmon producers around the world, and particularly for those in the Atlantic Ocean where widespread EMB tolerance in sea lice is recognized as a significant problem. Salmon farms in the Northeast Pacific Ocean have not historically experienced the same issues with treatment efficacy, possibly due to the relatively large population of endemic salmonid hosts that serve to both redistribute surviving lice and dilute populations potentially under selection by introducing naïve lice to farms. Frequent migration of lice among farmed and wild hosts should limit the effect of farm-specific selection pressures on changes to the overall allele frequencies of sea lice in the Pacific Ocean. A previous study using microsatellites examined *L. salmonis* *oncorhynchi* from 10 Pacific locations from wild and farmed hosts and found no population structure. Recently however, a farm population of sea lice was detected where EMB bioassay exposure tolerance was abnormally elevated. In response, we have developed a Pacific louse draft genome that complements the previously-released Atlantic louse sequence. These genomes were combined with whole-genome re-sequencing data to design a highly sensitive 201,279 marker SNP array applicable for both subspecies (90,827 validated Pacific loci; 153,569 validated Atlantic loci). Notably, kmer spectrum analysis of the re-sequenced samples indicated that Pacific lice exhibit a large within-individual heterozygosity rate (average of 1 in every 72 bases) that is markedly higher than that of Atlantic individuals (1 in every 173 bases). The SNP chip was used to produce a high-density map for Atlantic sea louse linkage group 5 that was previously shown to be associated with EMB tolerance in Atlantic lice. Additionally, 478 Pacific louse samples from farmed and wild hosts obtained between 2005 and 2014 were also genotyped on the array. Clustering analysis allowed us to detect the apparent emergence of an otherwise rare genotype at a high frequency among the lice collected from two farms in 2013 that had reported elevated EMB tolerance. This genotype was not observed in louse samples collected from the same farm in 2010, nor in any lice sampled from other locations prior to 2013. However, this genotype was detected at low frequencies in louse samples from farms in two locations reporting elevated EMB tolerance in 2014. These results suggest that a rare genotype present in Pacific lice may be locally expanded in farms after EMB treatment. Supporting this hypothesis, 437 SNPs associated with this genotype were found to be in a region of linkage group 5 that overlaps the region associated with EMB resistance in Atlantic lice. Finally, five of the top diagnostic SNPs within this region were used to screen lice that had been subjected to an EMB survival assay, revealing a significant

* Corresponding author at: Department of Biology, University of Victoria, Victoria V8W 2Y2, BC, Canada.

E-mail addresses: amessmer@uvic.ca (A.M. Messmer), jong@uvic.ca (J.S. Leong), erondeau@uvic.ca (E.B. Rondeau), anita.mueller77@yahoo.de (A. Mueller), cdespains@uvic.ca (C.A. Despains), dminkley@uvic.ca (D.R. Minkley), matthew.peter.kent@nmbu.no (M.P. Kent), sigbjorn.lien@nmbu.no (S. Lien), brad.boyce@marineharvest.com (B. Boyce), diane.morrison@marineharvest.com (D. Morrison), mfast@upei.ca (M.D. Fast), jonorman@gmail.com (J.D. Norman), rdanzman@uoguelph.ca (R.G. Danzmann), bkoop@uvic.ca (B.F. Koop).

¹ Contributed equally to this work.

<https://doi.org/10.1016/j.margen.2018.03.005>

Received 13 September 2017; Received in revised form 28 February 2018; Accepted 27 March 2018

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**Pages 690 to / à 701
are withheld pursuant to section
sont retenues en vertu de l'article**

68(a)

**of the Access to Information Act
de la Loi sur l'accès à l'information**

Waddington, Zac

From: Webb, Allison
Sent: May-30-18 1:41 PM
To: Waddington, Zac; Doucette, Claire; Paylor, Adrienne
Cc: Sandberg, Krista
Subject: RE: Lice abundance and "absolute sea lice inventory" graphs and data

Thanks for this info Zac. Important to know and recognise that our approach to managing sea lice will need to evolve as we discussed last week and your team is already actioning. I know that you and/or Adrienne will keep me posted.

Best,
Allison

Allison Webb, Director / Directrice
Aquaculture Management / Gestion de l'aquaculture
Fisheries Management Branch / Direction de la gestion des pêches
Fisheries and Oceans Canada / Pêches et Océans Canada
200 - 401 Burrard St / Rue Burrard, Vancouver BC / C.B. V6C 3S4 Canada
604-666-7009
Allison.webb@dfo-mpo.gc.ca

From: Waddington, Zac
Sent: 2018-May-29 2:27 PM
To: Doucette, Claire; Paylor, Adrienne; Webb, Allison
Cc: Sandberg, Krista
Subject: Lice abundance and "absolute sea lice inventory" graphs and data

Please see the link below to look at the graphs which Krista has created outlining the lice levels on farms in Clayoquot, and the respective farm inventories. Of particular note is the tab labelled "Total Lice Abundance" which is plots the "absolute lice inventory" as referenced in Section 6.4(a) of the conditions of licence. You can clearly see that for the months which we have inventory and lice data during the outmigration (March and April), there was a consistent trend upwards of most of the sites, and only in April was there a reduction in absolute lice inventory at two sites (Ross and Millar; both of whom are now harvested out). That leaves Bawden, Dixon Bay, Mussel Rock, Rant and Saranac Island all over threshold with upwards trends in absolute sea lice inventory.

Zac

From: Sandberg, Krista
Sent: May-29-18 12:44 PM
To: Waddington, Zac; Manchester, Howie; Keith, Ian
Subject: RE: bioassay

Hey guys, I've updated all the graphs to include April data, including addition of harvest plans to the harvesting graph. Enjoy ☺

[\\svbcbvanfp01\aquas\AEO\Courtenay\FH\sea lice management\Sea Lice - Clayoquot graphs 2017.xls](#)

Krista Sandberg
Office | Bureau 250-286-5835
Cellular | Cellulaire [REDACTED]

s.16(2)(c)



Government
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Gouvernement
du Canada

Canada

From: Waddington, Zac
Sent: May-29-18 9:26 AM
To: Sandberg, Krista; Manchester, Howie; Keith, Ian
Subject: Re: bioassay

Thanks a bunch Krista. I know your super busy, but is there anyway you could generate the "absolute sea lice inventory" graph for sites using the April lice and inventory data as was done for March? It'll be important for C and P, I'm expecting to have a meeting with them later this week at some point.

Zac

From: Sandberg, Krista
Sent: Tuesday, May 29, 2018 11:16 AM
To: Manchester, Howie; Waddington, Zac; Keith, Ian
Subject: RE: bioassay

I updated the inventory files yesterday. Miller and Ross are empty, and it looks like they are currently harvesting from Mussel and Saranac with plans to empty Dixon in June.

Krista.

Krista Sandberg
Office | Bureau 250-286-5835
Cellular | Cellulaire [REDACTED]



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of Canada

Gouvernement
du Canada

Canada

From: Manchester, Howie
Sent: May-29-18 7:09 AM
To: Waddington, Zac; Keith, Ian
Cc: Sandberg, Krista
Subject: RE: bioassay

Thanks for this. I would ask that if we are to go ahead that one of you give [REDACTED] the heads up and let him know we will be contacting [REDACTED] to arrange for Thursday. As for the farms I believe Ross is now empty and Dixon is aggressively harvesting, not sure when harvest ends at Dixon and whether we can get lice while they are harvesting. So as far as who is left to get lice from I believe Bawden is the next candidate. We could look at Saranac and Rant but I don't know if they showed obvious failure in Krista's graphs.

I'm out in the field all day today but will look at data tonight, If you have time to pick a good candidate site that would be great, anyways keep me posted on whether it's a go or not.

Thanks

Howie

From: Waddington, Zac
Sent: May-29-18 4:34 AM
To: Keith, Ian

s.16(2)(c)

s.19(1)

Cc: Manchester, Howie
Subject: RE: bioassay

[REDACTED] I am really curious for your opinion when/if [REDACTED] gets back to you with his bioassay results, and if you are satisfied with what he provides. I do not have a minimum testing standard in mind that would satisfy me, but my rationale was that if [REDACTED] provided good evidence of resistance then our own sampling wouldn't be necessary. My thoughts would be that if there's any doubt about whether [REDACTED] bioassay results show resistance, or is he doesn't get them to us in time, then we should just plan to collect our own samples. So at this point I would suggest that Howie and team plan to collect lice on Thursday from the most convenient site with a documented SLICE failure (as based on the graphs Krista generated). I'm not sure of the state of harvest at Ross and Dixon, but they both had quite high lice levels. Does that sound like a workable plan?

Zac

From: Keith, Ian
Sent: May-28-18 6:54 PM
To: Waddington, Zac
Cc: Manchester, Howie
Subject: bioassay

Hey,
[REDACTED] (I'm assuming the meeting is in Quebec.)
I had a response [REDACTED] about missed fish health events but have had no email about bioassay results. Howie would like to know tomorrow if they are to go ahead on Thursday, so I can phone [REDACTED] tomorrow to ask about bioassays he will be sharing. Is there some minimum that would satisfy you, or is your wish to have our independently collected lice for our own data? I don't know how C&P advised you – [REDACTED]

Thanks

Ian
Ps: Howie was at Fortune today – [REDACTED] fish, March entry, and they are just exceeded threshold now. I'll ask [REDACTED] tomorrow what the plan is for these fish.

Pps: [REDACTED]

Dr. Ian Keith DVM
Field Operations Veterinarian – Pacific Region
Fisheries and Oceans Canada | Pêches et Océans Canada
Fisheries Management
Aquaculture Management Division | Gestion de l'aquaculture
Aquaculture Environmental Operations – Fish Health
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Telephone | Téléphone: 250-703-0917
Mobile | Portable: [REDACTED]
Fax | Télécopieur: 250-703-0921
Ian.Keith@dfo-mpo.gc.ca

s.16(2)(c)
s.19(1)
s.20(1)(b)
s.21(1)(a)
s.21(1)(b)

Manchester, Howie

From: Manchester, Howie
Sent: May-30-18 5:26 PM
To: 'BawdenPoint Farm'
Cc: [REDACTED] Waddington, Zac; Keith, Ian
Subject: RE: Bioassay Lice Collection at Bawden

Hi [REDACTED]

I'm thinking the reference pen may be a good choice but basically whichever pen has the highest number of motile lice. If there is no or little difference between the pens as far as lice abundance then we can go with the reference pen, if not pick a pen with higher numbers. Also to consider is if you just recently handled a pen for lice you may not want to handle that pen again and give it a break.

If anyone else has input please comments.

We will see you on site at about 8:30 am, please let me know if you have any further questions.

Thanks

Howie

From: BawdenPoint Farm [REDACTED]
Sent: May-30-18 2:08 PM
To: Manchester, Howie
Cc: [REDACTED]
Keith, Ian;
Waddington, Zac
Subject: Re: Bioassay Lice Collection at Bawden

Which pen did you want to sample from?

[REDACTED]
BawdenPoint Farm

CERMAQ

Phone + [REDACTED]
Direct +1 250-286-0022 ext [REDACTED]

Cermaq Canada Ltd.

Canada

Cermaq.ca [Facebook](#) [Twitter](#)

s.16(2)(c)
s.19(1)

From: "Manchester, Howie" <Howie.Manchester@dfo-mpo.gc.ca>

To: [REDACTED]

Cc: [REDACTED]

"Keith, Ian" <Ian.Keith@dfo-mpo.gc.ca>,
"Waddington, Zac" <Zac.Waddington@dfo-mpo.gc.ca>

BawdenPoint Farm

Date: 30/05/2018 11:02 AM

Subject: Re: Bioassay Lice Collection at Bawden

Okay thanks for setting this up [REDACTED] let the site know we will arrive tomorrow morning at Bawden at around 8:30 am at the latest.

Thanks again,

Howie

Sent from my BlackBerry 10 smartphone on the Bell network.

From: [REDACTED]

Sent: Wednesday, May 30, 2018 09:19

To: Manchester, Howie

Cc: [REDACTED]

Keith, Ian;

BawdenPoint Farm

Subject: Re: Bioassay Lice Collection at Bawden

Good morning Howie

Sorry for the late reply but just received conformation from all involved. Yes it is fine to conduct the Sea Lice collection at Bawden Point on Thursday.

[REDACTED] asked to please keep all the lice that die at the lowest levels and all the lice that survive the highest levels in 95% or 100% ethanol

Regards

CERMAQ

Phone +1 250-286-0022

Direct +1 250-286-0022 ext. [REDACTED]

Mobile +1 250-203-1807

Cermaq Canada Ltd.

#203-919 Island Hwy

V9W 2C2 Campbell River, BC, Canada

Cermaq.ca

[Facebook](#)

[Twitter](#)

s.16(2)(c)

s.19(1)

From: "Manchester, Howie" <Howie.Manchester@dfo-mpo.gc.ca>

To: [REDACTED]
Cc: [REDACTED] "Waddington, Zac" <Zac.Waddington@dfo-mpo.gc.ca>, "Keith, Ian" <Ian.Keith@dfo-mpo.gc.ca>
Date: 29/05/2018 05:35 PM
Subject: Bioassay Lice Collection at Bawden

Hi [REDACTED]

There has or will be some discussions between DFO veterinarians and Cermaq [REDACTED] regarding our DFO team conducting lice collections at Bawden Point in order to complete an independent SLICE bioassay.

We would like to complete the lice collection the morning of Thursday, May 31, sorry for the short notice, but please let me know if you can arrange this activity for this time, as you know we are currently in Tofino and this would be an opportune time for the collection.

We have our own collection equipment and based on the latest abundance numbers at Bawden, I would estimate we need to go through 100 to 150 fish, there will be two of us so I estimate approximately 2 – 3 hours on site and other than catching the fish we would be fairly self-sufficient .

If you would like to discuss further, please don't hesitate to call my cell (see below), either tonight or tomorrow morning, we will be out at Rant Point and Saranac most of the day tomorrow but won't leave the dock until 8:00 am.

Thank you

Howie
Howie Manchester BSc
Senior Aquatic Science Biologist
Fisheries and Oceans Canada / Pêches et Océans Canada
Aquaculture Management Division / Gestion de l'aquaculture
Aquaculture Environmental Operations - Fish Health
#103 2435 Mansfield Drive
Courtenay, B.C
Telephone | Telephone: 250 703 0916 | Cell: [REDACTED]
Fax: 250 703 0921

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Any unauthorised use, dissemination of the information or copying of this message is prohibited.

s.16(2)(c)

s.19(1)

Manchester, Howie

From: Keith, Ian
Sent: May-31-18 5:43 PM
To: Waddington, Zac; Manchester, Howie
Subject: FW: bioassay 'winners and losers' sample number

From: Mark Fast [<mailto:mfast@upei.ca>]
Sent: May-31-18 5:14 PM
To: Keith, Ian
Subject: Re: bioassay 'winners and losers' sample number

Hi Ian,

Thanks for getting in touch. Sorry was in the field working with sturgeon all day, just returned an hour ago.

Correct 40 dead lice at low EMB concentration (where death occurs) and 40 live at highest (where survival occurs) Hopefully these are well spread out (60 vs 500 or something like that). We need drastic phenotypes at this point - i.e. we already are confident in a general genomic region for resistance which we can only hone in on further if we have very drastic phenotypes from multiple places. One other thing would be to ensure that the controls are still all alive, as I'm sure you understand (just want to make as sure as we can - that EMB was cause of death in the dead lice). Even if we can only get 10 of each I would take it, especially if we could get similar collections from multiple sites.

Best case scenario is 40 live adult female (high conc.), 40 dead adult female (low conc.), and same for Adult male.

In the end, we need matched live and dead samples from the same sex and stage (20 Live adult female and 20 dead adult female; 10 live adult male and 10 dead adult male, etc.). If we can get all stages and sexes, fantastic, but let's start with adults and with at least one gender with same number of each live and dead.

Thanks for all your help

M

On Thu, May 31, 2018 at 1:56 PM, Keith, Ian <Ian.Keith@dfo-mpo.gc.ca> wrote:

Hi Mark,

As per a message on your answering machine, sampling from sea lice bioassay:

My assumption, 40 dead lice at the lowest concentration of EB; AND 40 live lice at the highest concentration where there is survival.

Into 95% ETOH

I believe that CAHS uses concentrations 0, 62.5, 125, 250, 500, 1000, but may start her concentration series at 31.25, I don't know and probit is probit.

I wanted to be sure we made good use of the effort so am double checking numbers and [REDACTED] didn't specify gendre or life stage. Adults only, pre-adults or adults? The lowest concentration where there is mortality greater than control level? The concentration at some nromalized threshold?

Thanks Mark. [REDACTED] said he was doing this for several farms, and we essentially are volunteering to do one of them. The lice are being collected today and the assay tomorrow.

Regards,

Ian

Dr. Ian Keith DVM

Field Operations Veterinarian – Pacific Region

Fisheries and Oceans Canada | Pêches et Océans Canada

Fisheries Management

Aquaculture Management Division | Gestion de l'aquaculture

Aquaculture Environmental Operations – Fish Health

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Ian.Keith@dfo-mpo.gc.ca

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s.19(1)

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Mark Fast, MSc, PhD
Associate Professor
Department of Pathology and Microbiology
Atlantic Veterinary College - University of Prince Edward Island
550 University Avenue
Charlottetown, PEI
C1A 4P3, Canada
E-mfast@upei.ca
T-1-(902)-620-5065
M- [REDACTED]

s.16(2)(c)

Manchester, Howie

From: Keith, Ian
Sent: May-31-18 5:42 PM
To: Manchester, Howie; Waddington, Zac
Subject: RE: Bioassay results [REDACTED]

They've left and Mark Fast replied with a detailed email just in time.
I'll forward it – Mark [REDACTED] I'm glad I asked for detail.
Ian

From: Manchester, Howie
Sent: May-31-18 4:54 PM
To: Waddington, Zac
Cc: Keith, Ian
Subject: Re: Bioassay results [REDACTED]

FYI. Approximately 2000 lice on their way to CAHS., should be there by 6 pm. All went well.

Howie

Sent from my BlackBerry 10 smartphone on the Bell network.

From: Waddington, Zac
Sent: Wednesday, May 30, 2018 10:56
To: Manchester, Howie
Cc: Keith, Ian
Subject: Re: Bioassay results [REDACTED]

Hey I've chatted with Ian, whose chatted [REDACTED] and we are a go for live sampling and bioassay at Bawden. [REDACTED] has been working with Mark Fast looking at resistance genetics and so this sample will be able to contribute to that work.

Ian is going to confirm things with [REDACTED] CAHS so we should be good to go there.

Thanks again for making this happen.

Zac

From: Manchester, Howie
Sent: Wednesday, May 30, 2018 9:48 AM
To: Waddington, Zac; Keith, Ian
Subject: Re: Bioassay results [REDACTED]

Okay, I'm not sure what lice Ben Koop needs, I thought the lice from Bawden were going to CAHS for a Bio assay.

We are and have been collecting lice in ethanol from fortune, Plover, Bare Bluff. We are collecting lice from Saranac and Rant today to ethanol. I assume these are for Ben? We are only collecting 20 to 30 lice in ethanol, I assume this is enough?

s.19(1)

Regardless let me know if we are not doing the bioassay as I need to let Cermaq [REDACTED] know one way or the other.

Thanks

Howie

Sent from my BlackBerry 10 smartphone on the Bell network.

From: Waddington, Zac
Sent: Wednesday, May 30, 2018 06:20
To: Keith, Ian
Cc: Manchester, Howie
Subject: RE: Bioassay results [REDACTED]

Yes I am inclined to agree with you Ian. This is way more bioassay data, and more recent then I thought we would get. I'd like to fire an email to Ben Koop and see if he could do anything more with the lice if we were to collect them, but my thoughts are that collecting these lice strictly for a bioassay wouldn't tell us more than we know now that [REDACTED] has shared those results. Sorry for the run around Howie. For now can we leave the plan as is to collect lice at Bawden, but if Ben Koop tells me that the lice wouldn't be of any use to him, then I'm inclined to pull the plug on the sampling and save you guys' time and efforts.

Zac

From: Keith, Ian
Sent: May-30-18 1:11 AM
To: Waddington, Zac
Cc: Manchester, Howie
Subject: FW: Bioassay results [REDACTED]

Hi guys,
Sorry for the blank email – second time today. I thought that only [REDACTED] could do this.
[REDACTED] has sent his EC50 values for seven sites. He has a January 2018 for Bawden (pre-treatment), February 2018 for Saranac, and April 2018 for Rant.
He treated only Bawden.
He had no pre-treatment for Millar, Ross, Dixon from Summer/Fall 2017 but has included the post treatment from Millar (December 2017) and Ross (January 2018).

His historic EC50s are pre-treatment (May 2017) and pre-treatment (September 2017) for Saranac where he chose not to treat; he has followed this up with a February 2018 so a helpful time-course.
He has included Binns (March 2017) pre-treatment.

It is not unusual to have a 'need to know basis' decision [REDACTED] of whether or not to share data but when pushed he has complied, [REDACTED] he expects these data are ATIP vulnerable.

I will ask [REDACTED] tomorrow morning if Ben Koop has material for his study – he may have told me this but I would have to ask again. I think with or without Ben's analysis, there isn't a future for SLICE use in Clayoquot.

Based on this sharing I don't know that generating more bioassay data is necessary. As I have said, the motivation for generating our own data [REDACTED]

I think you have to use your

s.19(1)

s.21(1)(a)

s.21(1)(b)

instincts, and I used data and my instincts in the past [REDACTED]
would take advantage of it.

Ian

From: Keith, Ian
Sent: May-30-18 12:11 AM
To: Waddington, Zac
Cc: Manchester, Howie
Subject: Bioassay results [REDACTED]

Dr. Ian Keith DVM
Field Operations Veterinarian – Pacific Region
Fisheries and Oceans Canada | Pêches et Océans Canada
Fisheries Management
Aquaculture Management Division | Gestion de l'aquaculture
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Ian.Keith@dfo-mpo.gc.ca

s.16(2)(c)

s.19(1)

Manchester, Howie

From: Waddington, Zac
Sent: May-31-18 7:49 PM
To: Manchester, Howie
Subject: Re: Bioassay results [REDACTED]

Wow! I'll say so. I guess that's a bit telling regarding the lice numbers.

Zac

From: Manchester, Howie
Sent: Thursday, May 31, 2018 7:54 PM
To: Waddington, Zac
Cc: Keith, Ian
Subject: Re: Bioassay results [REDACTED]

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s.19(1)

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Zac

From: Keith, Ian
Sent: May-30-18 1:11 AM
To: Waddington, Zac
Cc: Manchester, Howie
Subject: FW: Bioassay results [REDACTED]

s.19(1)

s.21(1)(a)

s.21(1)(b)

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I think you have to use your

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would take advantage of it.

Ian

From: Keith, Ian
Sent: May-30-18 12:11 AM
To: Waddington, Zac
Cc: Manchester, Howie
Subject: Bioassay results

Dr. Ian Keith DVM
Field Operations Veterinarian – Pacific Region
Fisheries and Oceans Canada | Pêches et Océans Canada
Fisheries Management
Aquaculture Management Division | Gestion de l'aquaculture
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Ian.Keith@dfo-mpo.gc.ca

s.16(2)(c)
s.19(1)
s.21(1)(a)
s.21(1)(b)

Waddington, Zac

From: Keith, Ian
Sent: June-04-18 10:53 AM
To: Waddington, Zac
Subject: re:
Attachments: Calendar of events concerning Clayoquot.docx

An intro meeting with SEP in a couple of minutes so thought I should send this pre-event before what I we had prepared several months ago.

This is a different history and start than what Adrienne was expecting, I suspect, but there is history that I should fill you in on.

Thanks

Ian

Dr. Ian Keith DVM
Field Operations Veterinarian – Pacific Region
Fisheries and Oceans Canada | Pêches et Océans Canada
Fisheries Management
Aquaculture Management Division | Gestion de l'aquaculture
Aquaculture Environmental Operations – Fish Health
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Ian.Keith@dfo-mpo.gc.ca

s.16(2)(c)

Calendar of events concerning Clayoquot

- 22 August, Saranac notification with biweekly count as management plan
- 5 August, Fortune notification – no management plan written but bi-weekly counts, as Saranac
- 13 October 2017 submitted Appendix VI-A (sea lice counts for September)
 - Saranac: Reported September 16-23 area based treatment
 - Mussel: no notification necessary; abundance <3. Treated prior to submission of a plan but performed bioassay prior to area based treatment.
 - Millar: Submitted notification (Section 6.5) more than 30 days after 1st discovery (5 September) and area based treatment occurred prior to submission of a plan and without performing a pre-treatment bioassay. These fish were treated in June, with effect but with lower drug tissue levels than target. Now the same lice population was being treated with the same drug within 3 months, something that the regulator would not have agreed with. (Since the plan was not submitted and DFO is speaking retrospectively. But in BC, there is reliance on lice from wild fish 'diluting' the resistance genes before the lice population is treated again with the same drug. DFO vet has confidence that veterinary peers would agree with this opinion.)
 - Ross: Misreported. This report was submitted less than 30 days after 1st discovery, 20 September (Section 6.5). The report said there was "no action required." What is not clear is whether, given that the regulator may have accepted their bi-weekly counts as an accepted management action had this been in a submitted plan, with treatment after recruitment of lice from wild fish that predictably dilute the resistance genes in the lice on the farmed fish.
- 10 November 2017 submitted October sea lice counts
 - Ross: Submitted notification (Section 6.5) more than 30 days after 1st discovery (20 September) and area based treatment occurred prior to submission of a plan and without performing a pre-treatment bioassay. These fish were treated in June, with effect but with lower drug tissue levels than target. Now the same lice population was being treated with the same drug within 3 months, something that the regulator would not have agreed with. (Since the plan was not submitted and DFO is speaking retrospectively. But in BC, there is reliance on lice from wild fish 'diluting' the resistance genes before the lice population is treated again with the same drug. DFO vet has confidence that veterinary peers would agree with this opinion.)
 - Reported October 1 initiation of treatment – had not submitted notification of exceedance or area based treatment
 - Dixon: Reported October 5 initiation of treatment – technically fulfilled COL notification of exceedance 17 September in October report
 - Brent: Notification and management included in October report i.e. 5 November initiation of area based management
 - Venture: Notification and management plan included in October report i.e. 4 November initiation of area based management
- 22 November 2017, site visit to Ross

Keith, Ian

From: [REDACTED]
Sent: June-04-18 1:00 PM
To: Keith, Ian
Cc: [REDACTED]
Subject: Bioassay report for Bawden
Attachments: P-308 DFO Bedwell.xlsx

Hi Ian

I have completed the report for the Bioassay done for Bawden sea lice.

We had lot of lice so I increased the replicates to 4 per male and female and managed to get 2 trays of pre-adult females. I did a Probit for the 2 replicates of pre-females just to get an idea of what their levels were.

Please feel free to contact me if you have any questions.

Cheers,

[REDACTED]

BC Centre for Aquatic Health Sciences
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Mailing Address: PO Box 25070 Tyee, Campbell River, BC, Canada V9W 0B7
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email: [REDACTED]
web: www.caahs-bc.ca

s.19(1)

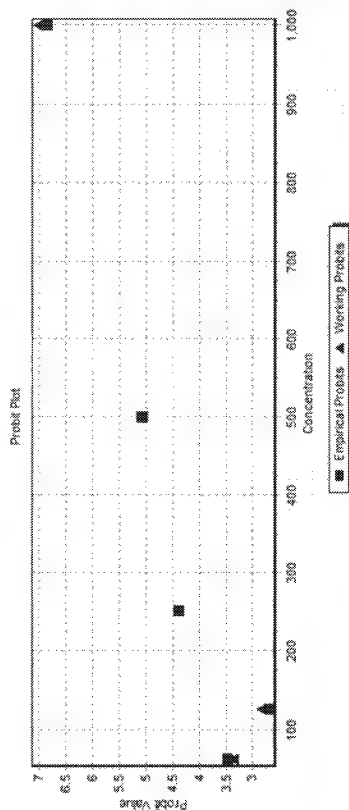


SEA LICE BIOASSAY RESULTS

Date submitted: 31-May-18 Farm Site: Bawden
 Company: Fisheries and Oceans Product Assayed: EMB
 Bioassay conducted 01-Jun-18

REP	1	2	3	4	5	6	7	8	9	10
	Female #1	Female #2	Female #3	Female #4	Male #1	Male #2	Male #3	Male #4	Pre-Female #1	Pre-female #2
Conc ppb										
0	10	10	10	10	11	10	10	11	10	10
62.5	10	10	10	9	10	10	10	10	10	10
125	10	10	10	10	10	10	10	10	10	10
250	10	10	10	10	10	10	9	10	10	10
500	10	10	10	10	10	10	10	10	10	10
1000	10	10	10	10	10	10	10	10	10	10
24Hr (# lice still alive - healthy and weak)	8	10	9	8	11	10	8	11	9	9
62.5	9	9	8	9	8	10	9	9	10	10
125	9	10	5	8	8	10	10	10	8	7
250	6	6	7	5	5	8	6	8	2	2
500	8	1	2	3	6	7	3	2	0	0
1000	2	1	1	0	1	0	0	0	0	0

Comments: The lice were in good condition when they arrived.
 Lice used for the bioassay were robust and healthy.

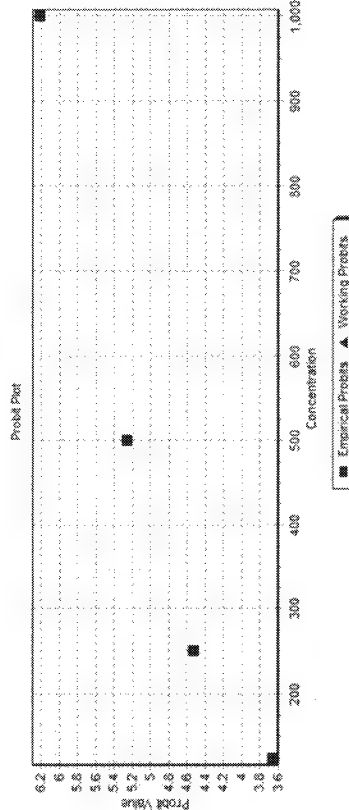


Results Males

Lethal value (50) = 388.3

Upper 95 %ile = 452.4

Lower 95 %ile = 333.2



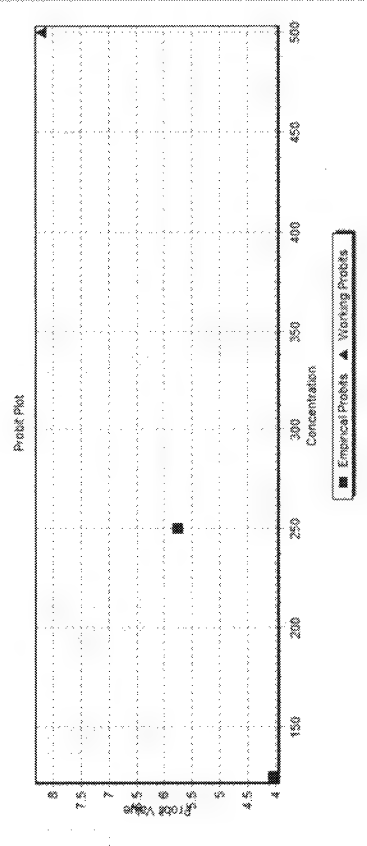
Results Adult Females

Lethal value (50) = 380.7

Upper 95 %ile = 459

Lower 95 %ile = 315.7

s.19(1)

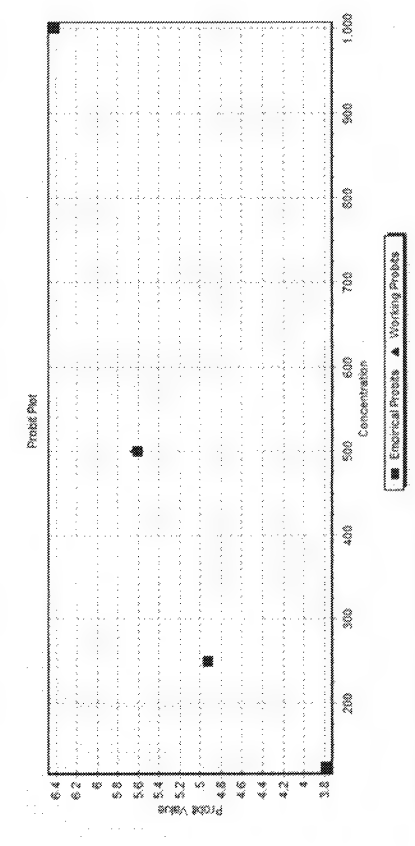


Results Pre adult females

Lethal value (50) = 181.3

Upper 95 %ile = 213

Lower 95 %ile = 154.3



Results Adult and Pre-adult females

Lethal value (50) = 297.6

Upper 95 %ile = 345.8

Lower 95 %ile = 256.2

s.19(1)

Waddington, Zac

From: Waddington, Zac
Sent: June-04-18 1:43 PM
To: Keith, Ian
Subject: RE: re:

Thanks very much for that Ian, I think that'll be hugely helpful. I'm guessing that we are going to need to prepare documentation regarding all the steps along the journey of this lice situation in Clayoquot.

Zac

From: Keith, Ian
Sent: June-04-18 10:53 AM
To: Waddington, Zac
Subject: re:

An intro meeting with SEP in a couple of minutes so thought I should send this pre-event before what I we had prepared several months ago.

This is a different history and start than what Adrienne was expecting, I suspect, but there is history that I should fill you in on.

Thanks

Ian

Dr. Ian Keith DVM
Field Operations Veterinarian – Pacific Region
Fisheries and Oceans Canada | Pêches et Océans Canada
Fisheries Management
Aquaculture Management Division | Gestion de l'aquaculture
Aquaculture Environmental Operations – Fish Health
#103 – 2435 Mansfield Drive
Courtenay, British Columbia V9N 2M2
Telephone | Téléphone: 250-703-0917
Mobile | Portable: [REDACTED]
Fax | Télécopieur: 250-703-0921
Ian.Keith@dfo-mpo.gc.ca

s.16(2)(c)

Waddington, Zac

From: Keith, Ian
Sent: June-05-18 12:59 PM
To: Waddington, Zac
Subject: RE: Bioassay report for Bawden

Thanks but this requires judgement.

From: Waddington, Zac
Sent: June-05-18 12:48 PM
To: Keith, Ian
Subject: RE: Bioassay report for Bawden

Yeah I am very excited to see what comes of Mark Fast's work, moving away from bioassays would be hugely advantageous for numerous reasons. I will definitely keep you in the loop on this C and P action re: Clayoquot, so if you want to stay in Vancouver for those meetings you definitely should.

Zac

From: Keith, Ian
Sent: June-04-18 4:29 PM
To: Waddington, Zac
Subject: RE: Bioassay report for Bawden

My interpretation: Yes, assays not as high as some of the other sites but the adult female variability indicates to me that there some of the old surviving females (group 1). The hybrids with genes from the wild fish SL are represented in the female pre-adults (see little variability). [Note how there appears to be inducibility (see the male pre-adults). This is why industry would like genetic markers instead of bioassays.]

Your question is good though, why off the scale EC50 for Ross, because all the adult females from that assay would have survived 1000, not just one as in this bioassay. My guess is that before the wild genes come in, the picture could approach that of Ross.

I have attached the agenda for the meetings. The consensus is that all 3 days would be worth attending but Corino has left it up to me. He and Adrienne have an understanding and the objective is to let nothing fall through the cracks and Claire's efforts, not in a small part motivated by you and Adrienne, can't be squandered.

Ian

From: Waddington, Zac
Sent: June-04-18 3:20 PM
To: Keith, Ian
Subject: RE: Bioassay report for Bawden

Very interesting. Thanks very much for that Ian, that's very interesting. Not nearly as high as some of the other sites. I phoned [REDACTED] and chatted about sponsoring the new therapeutants coming down the line [REDACTED]

[REDACTED] Hope all went well with the SEP meetings. When are you back in the office?

Zac

From: Keith, Ian
Sent: June-04-18 1:50 PM

s.19(1)

To: Waddington, Zac

Subject: FW: Bioassay report for Bawden

Hi Zac,

Here are the Bawden bioassay results, which appear similar to 2018 Rant, Saranac and Ross ie adult females more resistant than adult males and pre-adults. The re-fresh as Howie calls it, the genetic influence from wild fish lice, are seen in the adult males and the pre-adults, but the adult females are the old genetics.

(Normally post treatment of wild lice, we see adult males has more resistant. My working hypothesis is that there are inducible resistance mechanisms, for example, inducible enzymes.)

Ian

From: [REDACTED]

Sent: June-04-18 1:00 PM

To: Keith, Ian

Cc: [REDACTED]

Subject: Bioassay report for Bawden

Hi Ian

I have completed the report for the Bioassay done for Bawden sea lice.

We had lot of lice so I increased the replicates to 4 per male and female and managed to get 2 trays of pre-adult females. I did a Probit for the 2 replicates of pre-females just to get an idea of what their levels were.

Please feel free to contact me if you have any questions.

Cheers,

[REDACTED]

BC Centre for Aquatic Health Sciences

Street Address: 871A Island Hwy, Campbell River, BC

Mailing Address: PO Box 25070 Tyee, Campbell River, BC, Canada V9W 0B7

ph: 250 286-6102 f: 250 286-6103

email: [REDACTED]

web: www.caahs-bc.ca

s.19(1)

Paylor, Adrienne

From: Paylor, Adrienne
Sent: June-08-18 10:12 AM
To: Webb, Allison
Cc: McCorquodale, Brenda; Lavigne, Lauren
Subject: Fw: sea lice bullets for Allison
Attachments: Bullets on sea lice situation to brief Andy.docx

Allison attached bullets for you to brief Andy. Let me know if you need more info.

Thanks
Adrienne

Sent from my BlackBerry 10 smartphone on the Rogers network.

From: Waddington, Zac <Zac.Waddington@dfo-mpo.gc.ca>
Sent: Friday, June 8, 2018 9:29 AM
To: Paylor, Adrienne
Subject: RE: Can you clean this up for Allison 4 me?

Take a peek and see what you think.

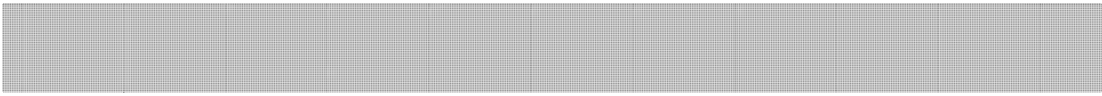
Zac

From: Paylor, Adrienne
Sent: June-08-18 8:26 AM
To: Waddington, Zac
Subject: Can you clean this up for Allison 4 me?

Bullets on sea lice situation to brief Andy

Bullets on sea lice situation to brief Andy

- Numerous Cermaq farms in Clayoquot are experiencing extremely high sea lice counts this spring.
- Experienced FH staff say this is the worst lice burden they have ever seen with an estimated 80 to 100 lice per fish seen during the most recent audits in the area in May.
 - FH staff have collected sea lice from the Bawden site and sent them to the Coastal Aquatic Health Center for genetic and bioassay studies which confirmed SLICE resistance.
- Documented SLICE failures have occurred at numerous locations on the west coast: Klemtu in 2015, Esperanza Inlet in 2017 and now Clayoquot sound in 2018.
 - Bioassay results conducted by industry and shared with DFO have confirmed that the lice are much more resistant to SLICE than wildtype lice.
- Area based SLICE treatments conducted in September and early October 2017 in Clayoquot had much lower effect than expected and resulted in lice numbers remaining high entering into 2018. SLICE resistance was documented by Cermaq's veterinarian.
- Cermaq's application for the use of peroxide (Paramove) was delayed by public opposition/consultation in Tofino and as a result their only management option remaining was harvest.
- In March 2018 four Cermaq farms were over threshold heading into the out migration window which included Bawden, Dixon, Miller and Ross.
 - Saranac quickly became over threshold by the middle of March.
 - In April 2018 Millar was harvested out and only Ross Pass was able to lower their "absolute sea lice inventory" in the month of April as defined in CoL, and was harvested out by the end of April.
 - Mussel Rock and Rant sites also went over the threshold in April and continue to be above.
 - Dixon Bay is being harvested rapidly and has also suffered a mortality event due to low oxygen, so it should be empty very shortly.
 - This leaves four farms that will have had elevated lice levels throughout the entirety of the outmigration period.
- A pesticide use permit (PUP) has recently been granted by the BC Ministry of Environment for Clayoquot and peroxide treatment is underway at Bawden and Plover Point.
- The failure by numerous farms to "implement a plan which will reduce the absolute sea lice inventory within the containment structure array," (CoL 6.4 (a)) may/should represent a non-compliance with CoL. [REDACTED]
- Moving forward it is imperative that no additional SLICE treatments occur in Clayoquot until at least after the fall adult migration occurs and bioassays show resistance genetics have been diluted from the sea lice population by the influx of wildtype lice.

- It is recommended that Cermaq demonstrate that they have the technology, training and capacity to treat all farms in Clayoquot in a timely manner without reliance on SLICE before restocking farms being harvested out.
- 
- This situation has highlighted the shortcomings of “harvest” as a management tool since harvest capacity at processing plants and harvest vessels is fixed and companies try to ensure they maintain peak efficiencies; therefore there is generally not additional capacity to allow harvesting as a management tool. This limitation has been encountered with all three major salmon farming companies, in three of the past four outmigration periods.
- Without effective enforcement, companies have a perverse incentive to use harvest as a management tool during the outmigration, which meets the letter of the CoL, but certainly not the spirit or objective of preventing undue lice challenge to outmigrating smolts.

Could talk about amending the licence to change the sea lice section at large???

s.21(1)(a)

s.21(1)(b)

Waddington, Zac

From: Paylor, Adrienne
Sent: June-08-18 3:04 PM
To: Waddington, Zac
Subject: Re: Can you clean this up for Allison 4 me?

Excellent thanks so much! I have passed them on to Allison so if anything else comes up to add just send it directly to her and cc me. 

Sent from my BlackBerry 10 smartphone on the Rogers network.

From: Waddington, Zac
Sent: Friday, June 8, 2018 9:29 AM
To: Paylor, Adrienne
Subject: RE: Can you clean this up for Allison 4 me?

Take a peek and see what you think.

Zac

From: Paylor, Adrienne
Sent: June-08-18 8:26 AM
To: Waddington, Zac
Subject: Can you clean this up for Allison 4 me?

Bullets on sea lice situation to brief Andy

Cermaq farms in Clayoquot counts are experiencing extremely high sea lice counts this spring AEO fish health have identified widespread SLICE resistance on the west coast of Vancouver Island, documented in Esperanza in 2017 and now Clayoquot in 2018. In March 2018 five Cermaq farms were over threshold heading into the out migration window which included Bawden, Dixon, Miller, Ross and Saranc. In April 2018 Millar was harvested out and only Ross Pass was able to lower their absolute sea lice inventory as defined in CoL. Mussel Rock and Rant sites went over the threshold. Experienced FH staff say this is the worst they have ever seem with an estimated 80 to 100 lice per fish be May. FH staff have collected sea lice from the Bawden site and sent them to the Coastal Aquatic Health Center for genetic and bioassay studies. SLICE resistance was confirmed. Moving forward it is imperative that no additional SLICE treatments occur in Clayoquot until after the fall adult migration occurs and bioassays show resistance had been eliminated from the sea lice population. A mandatory fallowing period may be required before farms are allowed to restock??? The department must expedite it IPM initiatives and consider Area Based Management approaches to sea lice management. Currently there are limited options for sea lice management without the use of SLICE in BC leaving only H2O2 if they can get through consultaion and get a permit from the province or harvest the fish out.

Excellerated harvest has been an acceptable submitted plan in the past however implementation of this plan has proven challenging do to limited capacity of harvest vessels and processing plants, weather delays and diverted resources to sites that go over biomass limits.

Economic losses from removing fish prior to market size provides industrty incentive to drag out the harvest.

Sent from my BlackBerry 10 smartphone on the Rogers network.

Paylor, Adrienne

From: Paylor, Adrienne
Sent: June-08-18 3:09 PM
To: Webb, Allison
Subject: [REDACTED]
Attachments: [REDACTED]

[REDACTED]
Adrienne

Sent from my BlackBerry 10 smartphone on the Rogers network.

From: Waddington, Zac <Zac.Waddington@dfo-mpo.gc.ca>
Sent: Friday, June 8, 2018 8:22 AM
To: Paylor, Adrienne
Cc: Webb, Allison
Subject: [REDACTED]

Yeah I can't open the old one now either...

Please take a peek at the attached documents. [REDACTED]
[REDACTED]

Zac

From: Paylor, Adrienne
Sent: June-08-18 7:41 AM
To: Waddington, Zac
Cc: Webb, Allison
Subject: [REDACTED]

Can you send [REDACTED] to Allison. My BlackBerry won(decode it.
Thx Adrienne

Sent from my BlackBerry 10 smartphone on the Rogers network.

s.19(1)
s.21(1)(a)
s.21(1)(b)
s.23

Pages 732 to / à 770
are withheld pursuant to section
sont retenues en vertu de l'article

23

of the Access to Information Act
de la Loi sur l'accès à l'information

Manchester, Howie

From: Diamond, Maria
Sent: June-12-18 4:05 PM
To: Waddington, Zac; Manchester, Howie
Subject: Sea Lice Overabundance

Just letting you both know that Cermaq has submitted overabundance notifications on Friday, June 8, 2018 for Bare Bluff, Fortune and Bedwell. [REDACTED] says they are waiting to negotiate use of another company boat in order to apply a Paramove treatment to the fish as well as doing bioassays for SLICE as a possible alternative treatment. However, there is no mention of a time frame for either of these possible treatments.

As well there is no notification of overabundance for Bawden. Zac did you already speak [REDACTED] regarding Bawden?

Maria

Maria Diamond, B.Sc.

Aquatic Science Biologist / Biologiste en sciences aquatiques
Aquaculture Management Division / Gestion de l'aquaculture
Aquaculture Environmental Operations/Opérations environnementales de l'aquaculture
Fisheries and Oceans Canada / Pêches et Océans Canada
#103 - 2435 Mansfield Drive
Courtenay, B.C
Office | Bureau: 250 703 0915
Fax: 250 703 0921



Government
of Canada

Gouvernement
du Canada

Canada

s.19(1)

Paylor, Adrienne

From: Paylor, Adrienne
Sent: June-13-18 3:10 PM
To: Webb, Allison
Subject: sea lice BN
Attachments: Sea Lice-Memo-.docx

I got a start. Perhaps we can finish it together?

Adrienne Paylor

Regional Manager, Aquaculture Environmental Operations
Fisheries and Oceans Canada / Pêches et Océans Canada
Aquaculture Management Division / Gestion de l'aquaculture
1520 Tamarac Street, Campbell River, BC V9W 3M5
Adrienne.paylor@dfo-mpo.gc.ca

Telephone | Téléphone 250-286-5817
Facsimile | Télécopieur 250-286-5837
Government of Canada | Gouvernement du Canada



Fisheries and Oceans
Canada

Pêches et Océans
Canada

Sector

Secteur

S/ADM Title

Titre de SMA/P

Issue subject to screen. Not to be shown to Minister LeBlanc. (if appropriate)

CLASSIFICATION (e.g. CONFIDENTIAL or SECRET)
+ Confidence of the Queen's Privy Council (for items that are Cabinet Confidence)
+SOLICITOR-CLIENT PRIVILEGE / LITIGATION PRIVILEGE (if appropriate)

20##-###-#####
EKME #: #####

MEMORANDUM FOR THE DEPUTY MINISTER

SEA LICE MANAGEMENT ISSUE IN PACIFIC REGION (FOR INFORMATION / FOR DECISION)

SUMMARY OF ADVICE TO DEPUTY MINISTER

The purpose of this note is to bring to your attention a growing pattern of sea lice management challenges on the west coast of Vancouver Island

Within the last three years the department has become aware of SLICE treatment failures starting with Klemtu in 2015, Esperanza Inlet in 2017 and now Clayoquot sound in 2018.

This situation has raised media attention and public concern over harm to salmon smolts during out migration periods. The department will have to take action to address the shortcomings of sea lice management approaches in the Pacific Region.

Immediate next steps include internal discussions on possible alternative management approaches and continued collaboration with communication to respond to media and public inquires.

Medium to long term actions will include consultation with Science, Industry and the province on improved Integrated Pest Management approaches.

BACKGROUND

Numerous Cermaq farms in Clayoquot Sound are experiencing extremely high sea lice counts (80 to 100 lice per fish) this spring. When lice levels cannot be managed there is spillover of farmed lice onto migrating smolts increasing the risk of detrimental effects to wild fish.

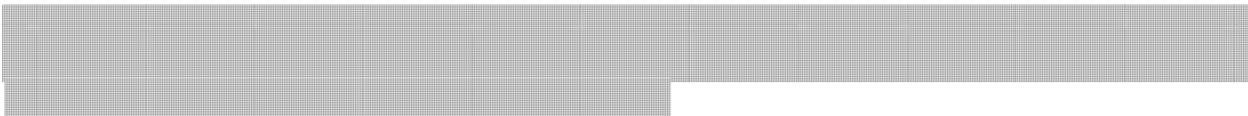
At present, there are few options available to the aquaculture industry to reduce the absolute sea lice inventory and those available, can result in the potential for sea lice resistance (SLICE), or take a substantial period of time to implement and complete, i.e. harvesting.

Area based SLICE treatments conducted in September and early October 2017 in Clayoquot had much lower effect than expected and resulted in lice numbers remaining high entering into 2018. Aquaculture Management staff have collected sea lice samples from one of the 7 sites over regulatory thresholds and have confirmed SLICE resistance.

Alternative treatment was pursued by Cermaq however their application for the use of peroxide (Paramove) was delayed by public opposition/consultation in Tofino and as a result their only management option remaining was harvest.

Accelerated harvest is challenged by capacity at processing plants and harvest vessels limiting is effectiveness as a management tool. In the case of Clayoquot in 2018, there were also demands for harvesting efforts to be redirected other farms to ensure they remained below the maximum tonnage of fish allowed on the farm according to conditions of licence (CoL).

The failure by numerous farms to “implement a plan which will reduce the absolute sea lice inventory within the containment structure array,” (CoL 6.4 (a)) may/should represent a non-compliance with CoL.



s.21(1)(a)

s.21(1)(b)

s.23

STRATEGIC CONSIDERATIONS

This situation has highlighted the shortcomings of “harvest” as a management tool since harvest capacity at processing plants and harvest vessels is fixed and companies try to ensure they maintain peak efficiencies; therefore there is generally not additional capacity to allow harvesting as a management tool. This limitation has been encountered with all three major salmon farming companies, in three of the past four outmigration periods.

It is imperative that no additional SLICE treatments occur until at least after the fall adult migration occurs and bioassays show resistance genetics have been diluted from the sea lice population by the influx of wildtype lice. A mandatory fallowing period may be required before farms are allowed to restock.

Changes may be required to the conditions of licence and consideration given to the current thresholds for sea lice management

.../3

SCIENCE ADVICE

This section is where the Department presents its science advice. It is mandatory for fisheries and resource management decisions, as well as notes which include important science considerations (e.g., external reports with science-related recommendations, etc.).

It is optional for all other notes.

Where not relevant – this section can be excluded in full.

INTERDEPARTMENTAL CONSULTATIONS

Identify which departments/agencies were consulted in the development of the advice/briefing note, and their views.

INDIGENOUS CONSULTATIONS

Detail consultations with indigenous groups in the development of the advice/briefing note (as appropriate). Where not relevant this section can be excluded in full.

EXTERNAL CONSULTATIONS

Aquaculture Management plans to engage with industry through our advisory process to highlight the need for an improved approach to management going forward.

ADVICE AND RECOMMENDATIONS TO DEPUTY MINISTER

When the memo is for information, this section presents the conclusion of the memo.

When relevant, next steps can also be identified.

When the memo is for decision, this section presents the recommendation(s) for the Deputy Minister.

S/ADM Signature Block

Other ADM Signature Block (if applicable)

(Signature block below is for decision only)

☐ I concur with the recommendations

☐ I do not concur with the recommendations

.../4

Catherine Blewett
Deputy Minister

Kevin Stringer / Jeffery Hutchinson
Associate Deputy Minister / Commissioner

Attachment(s): (#) *(if applicable)*

1) Description of the attachment(s)



CLASSIFICATION
GCCMS #: 20##-###-#####
EKME #: #####

To: Catherine Blewett
Pour:

Date:

Object: **TITLE**
Objet: **TITRE**

From / Name of DG, Title
De:

Via: Name of S/ADM, Title

Additional approvals:
Autre(s) approbation(s):

☐

Material for the Minister
Documents pour le Ministre

☐

Your Signature
Votre signature

☐

Information

Screen: The Department has assessed this issue in full.
Filtre: ☐ It contains no reference to matters covered by the screen relating to J.D. Irving Limited.
☐ It contains matters referenced in the screen relating to J.D. Irving Limited, but in our view does not engage the screen.
☐ In our view, the screen relating to J.D. Irving Limited should be engaged.

Remarks: This briefing note was developed in consultation with the following
Remarques: regions/sectors: [please list who was consulted internally]

Distribution: *Please indicate name of people to receive a copy and if prior or following the DM approval. (Remove text if no Distribution is required)*

Drafting Officer/
Rédacteur:

NAME (TEL #)/ Director / admin initials

Waddington, Zac

From: Waddington, Zac
Sent: June-14-18 10:21 AM
To: Rainer, Michelle
Subject: Re: Sea lice update

Will do.

Zac

From: Rainer, Michelle
Sent: Thursday, June 14, 2018 10:05 AM
To: Waddington, Zac
Subject: RE: Sea lice update

Thanks, Zac. Later today would be fine if you're able.

From: Waddington, Zac
Sent: June-14-18 10:05 AM
To: Rainer, Michelle
Subject: Re: Sea lice update

The additions look really good to me, I'm in a meeting so can't do track changes yet. When do you need this response by?

Zac

From: Rainer, Michelle
Sent: Thursday, June 14, 2018 8:50 AM
To: Waddington, Zac
Subject: FW: Sea lice update

Hi Zac,

In light of the below, I have updated the Cermaq sea lice lines but thought the section on your review of their records might be out-of-date. Can you please review and update as needed?

Thanks,
Michelle

From: Webb, Allison
Sent: Tuesday, June 12, 2018 7:48 PM
To: Thomson, Andrew; LaRue, Jean-François
Cc: Girouard, Louise
Subject: Sea lice update

Andy and JF – Just a heads up on an issue that has been playing out recently and on which our team is spending significant time. I wanted you to be aware. No additional media attention has followed after the initial stories in Clayoquot Sound.

Please feel free to inform others like Rebecca as necessary.

- Numerous Cermaq farms in Clayoquot Sound are experiencing extremely high sea lice counts this spring. This is of concern for a number of reasons including timing of out migration of wild salmon smolts, indications of SLICE resistance and limited regulatory tools to address this situation.
- Experienced FH staff note that this is the worst lice burden they have ever seen with an estimated 80 to 100 lice per fish seen during the most recent audits in the area in May.
 - FH staff have collected sea lice from the Bawden site and sent them to the Coastal Aquatic Health Center for genetic and bioassay studies which confirmed SLICE resistance.
- Documented SLICE failures have occurred at numerous locations on the west coast: Klemtu in 2015, Esperanza Inlet in 2017 and now Clayoquot sound in 2018 increasing our need to find more effective management approaches to address this situation.
- Area based SLICE treatments conducted in September and early October 2017 in Clayoquot had much lower effect than expected and resulted in lice numbers remaining high entering into 2018. SLICE resistance was documented by Cermaq's veterinarian.
- Cermaq's application for the use of peroxide (Paramove) was delayed by public opposition/consultation in Tofino and as a result their only management option remaining was harvest.
- In March 2018 four Cermaq farms were over threshold heading into the out migration window which included Bawden, Dixon, Miller and Ross.
- A pesticide use permit (PUP) has recently been granted by the BC Ministry of Environment for Clayoquot and peroxide treatment is underway at Bawden and Plover Point.
- The failure by numerous farms to "implement a plan which will reduce the absolute sea lice inventory within the containment structure array," (CoL 6.4 (a)) may/should represent a non-compliance with CoL.
- We have been working with Cermaq (who have voluntarily withdrawn their ASC certification as they recognize that this is not being managed in a way consistent with the ASC), but are concerned that they may not be meeting the COL
- [REDACTED]
- We plan to raise this with industry through our advisory process to highlight the need for an improved approach to management going forward. We flagged this with BCSFA and they agreed that this was important.

Forward Options for consideration

- no additional SLICE treatments occur until at least after the fall adult migration occurs and bioassays show resistance genetics have been diluted from the sea lice population by the influx of wildtype lice.
- A mandatory fallowing period may be indicated before farms are allowed to restock.
- This situation has highlighted the shortcomings of "harvest" as a management tool since harvest capacity at processing plants and harvest vessels is fixed and companies try to ensure they maintain peak efficiencies; therefore there is generally not additional capacity to allow harvesting as a management tool. This limitation has been encountered with all three major salmon farming companies, in three of the past four outmigration periods.

s.21(1)(a)

s.21(1)(b)

s.23

- Changes may be required to the conditions of licence and consideration given to the current thresholds for sea lice management

No information has been removed or severed from this page

Waddington, Zac

From: Waddington, Zac
Sent: June-14-18 12:50 PM
To: Rainer, Michelle
Subject: RE: Sea lice update
Attachments: ML_AQUA_SeaLiceClayoquot.doc

Please see the attached document with my edits.

Zac

From: Rainer, Michelle
Sent: June-14-18 8:50 AM
To: Waddington, Zac
Subject: FW: Sea lice update
Importance: High

Hi Zac,

In light of the below, I have updated the Cermaq sea lice lines but thought the section on your review of their records might be out-of-date. Can you please review and update as needed?


Thanks,
Michelle

From: Webb, Allison
Sent: Tuesday, June 12, 2018 7:48 PM
To: Thomson, Andrew; LaRue, Jean-François
Cc: Girouard, Louise
Subject: Sea lice update

Andy and JF – Just a heads up on an issue that has been playing out recently and on which our team is spending significant time. I wanted you to be aware. No additional media attention has followed after the initial stories in Clayoquot Sound.

Please feel free to inform others like Rebecca as necessary.

- Numerous Cermaq farms in Clayoquot Sound are experiencing extremely high sea lice counts this spring. This is of concern for a number of reasons including timing of out migration of wild salmon smolts, indications of SLICE resistance and limited regulatory tools to address this situation.
- Experienced FH staff note that this is the worst lice burden they have ever seen with an estimated 80 to 100 lice per fish seen during the most recent audits in the area in May.
 - FH staff have collected sea lice from the Bawden site and sent them to the Coastal Aquatic Health Center for genetic and bioassay studies which confirmed SLICE resistance.
- Documented SLICE failures have occurred at numerous locations on the west coast: Klemtu in 2015, Esperanza Inlet in 2017 and now Clayoquot sound in 2018 increasing our need to find more effective management approaches to address this situation.

- Area based SLICE treatments conducted in September and early October 2017 in Clayoquot had much lower effect than expected and resulted in lice numbers remaining high entering into 2018. SLICE resistance was documented by Cermaq's veterinarian.
- Cermaq's application for the use of peroxide (Paramove) was delayed by public opposition/consultation in Tofino and as a result their only management option remaining was harvest.
- In March 2018 four Cermaq farms were over threshold heading into the out migration window which included Bawden, Dixon, Miller and Ross.
- A pesticide use permit (PUP) has recently been granted by the BC Ministry of Environment for Clayoquot and peroxide treatment is underway at Bawden and Plover Point.
- The failure by numerous farms to "implement a plan which will reduce the absolute sea lice inventory within the containment structure array," (CoL 6.4 (a)) may/should represent a non-compliance with CoL.
- We have been working with Cermaq (who have voluntarily withdrawn their ASC certification as they recognize that this is not being managed in a way consistent with the ASC), but are concerned that they may not be meeting the COL
- 
- We plan to raise this with industry through our advisory process to highlight the need for an improved approach to management going forward. We flagged this with BCSFA and they agreed that this was important.

Forward Options for consideration

- no additional SLICE treatments occur until at least after the fall adult migration occurs and bioassays show resistance genetics have been diluted from the sea lice population by the influx of wildtype lice.
- A mandatory fallowing period may be indicated before farms are allowed to restock.
- This situation has highlighted the shortcomings of "harvest" as a management tool since harvest capacity at processing plants and harvest vessels is fixed and companies try to ensure they maintain peak efficiencies; therefore there is generally not additional capacity to allow harvesting as a management tool. This limitation has been encountered with all three major salmon farming companies, in three of the past four outmigration periods.
- Changes may be required to the conditions of licence and consideration given to the current thresholds for sea lice management

s.21(1)(a)

s.21(1)(b)

s.23

DRAFT

MEDIA LINES

Title

Issue:

A number of farms in British Columbia's Clayoquot Sound area, all owned by Cermaq Canada, are experiencing extremely high sea lice counts this spring. This has already received media attention and lines have been approved.

Since then, lab tests have confirmed that the sea lice at least one of the farms are resistant to SLICE, which is the chemical treatment most widely used to control sea lice in BC. A "responsive" section has been added to media lines in anticipation of further media requests.

Media lines:

- Fisheries and Oceans Canada (DFO) is aware of the sea lice exceedances at Cermaq Canada's facilities in Clayoquot and has been in ongoing discussions with the company since January 2018 about measures to reduce sea lice levels. **approved**
- The Department is reviewing Cermaq Canada's sea lice management practices at these farms to determine if relevant licence conditions have been followed appropriately. **approved**
- Under the Pacific Aquaculture Regulations, DFO requires salmon farming companies to regularly monitor and manage sea lice levels at their facilities in BC. DFO also regularly conducts assessments of sea lice abundance at these facilities. **approved**
- Companies in BC must submit a lice reduction plan if monitoring shows sea lice levels higher than three motile sea lice per farmed fish during the wild salmon outmigration period from March 1 to June 30 of each year. Motile lice are those at the free-moving stages of their life cycle. **approved**
- DFO makes reports on the numbers of sea lice at BC aquaculture farms available to the public at www.dfo-mpo.gc.ca/aquaculture/protect-protege/parasites-eng.html. **approved**
- Salmon farming companies use an in-feed therapeutant called SLICE (emamectin benzoate) to reduce lice abundance. In cases where the use of SLICE does not result in adequate reduction of sea lice, companies can apply to the province of British Columbia for a permit to use alternative treatments, including Paramove (a hydrogen peroxide bath). Please contact Cermaq or the

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Created on: 14-Jun-18 6 Apr 11
Created by: Hélène Taché
Docket #:

Last saved by: DFO-MPOZacW
Revised: 14-Jun-18 2:20 PM 2:20 PM 12:49 PM

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Province of BC's Ministry of Environment for further information on this process. **approved**

- Hydrogen peroxide is widely used around the world, including elsewhere on Canada's west coast, with excellent effect and no demonstrable effects to the ecosystem. This pesticide is not absorbed by the fish and is non-toxic to humans. It also dissipates as a neutralized substance quickly in the environment and causes no discernible far-field effect. **approved**
- Our fish health veterinarians have requested documentation to determine the appropriateness of treatments undertaken at these farms, and to ensure that all other treatment and harvest options were duly considered by Cermaq. Financial considerations would not be recognized as justification for exclusion of otherwise effective lice management options. **approved**
- This is not a formal investigation under the Fisheries Act or regulations; however, if there has been non-compliance with the licence conditions, DFO will address the matter with an appropriate enforcement response. **approved**

Responsive on SLICE resistance (new)

- DFO collected sea lice from Cermaq Canada's Bawden site in the Clayoquot area and sent them to the BC Centre for Aquatic Health Sciences for analysis, which confirmed SLICE resistance. **new**
- In BC -SLICE has generally been a very effective tool in the management of sea lice at salmon farms. During most years, more than 90% of sites are below the regulatory thresholds for sea lice during the wild salmon outmigration period (from March 1 to June 30 of each year). **new**
- SLICE resistance is an emerging issue in BC, with failures of treatment documented at Klemtu in 2015, Esperanza Inlet in 2017 and now Clayoquot sound in 2018. **new**
- Research is under way, by DFO, industry, and academia, to find alternative methods to manage sea lice, and to better predict and track SLICE resistance. For instance, DFO is currently studying, or supporting research on, the use of Pacific perch as "cleaner fish" that eat sea lice off farmed fish and warm water baths to kill sea lice. More information on these projects can be found at www.dfo-mpo.gc.ca/aquaculture/sci-res/rd-eng.htm. **New**
- DFO is also supporting the licensing and approval process for alternative sea lice treatments, which are a necessary part of an integrated pest management approach. **New**

Spokesperson:

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Created on: 14-Jun-18 6-Apr-14
Created by: Hélène Taché
Docket #:

Last saved by: DFO-MPOZacW
Revised: 14-Jun-18 2:20 PM 2:20 PM 12:49 PM

DRAFT

Program Contact:

Communications Contact:

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Created by: Hélène Taché
Docket #:

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Higgins, Mark

From: Rainer, Michelle
Sent: June-22-18 11:45 AM
To: Higgins, Mark; Robson, Jim
Cc: Doucette, Claire
Subject: RE: herring die-off lines

Hi Jim,
Mark is available to speak to the FN about this; I'll leave the two of you to coordinate.
Thanks,
Michelle

From: Rainer, Michelle
Sent: June-22-18 11:40 AM
To: Doucette, Claire; Robson, Jim
Subject: herring die-off lines

Hi Jim,
I understand you are looking for someone to speak to Nuu-chal-nuth about this; I will contact science to see who is available.
Regards,
Michelle

Issue: Reports and photos of dead herring infested with sea lice in the Hot Springs Cove area near Tofino are being shared on Facebook, with claims that the event is linked to salmon farming:
https://www.facebook.com/zoceanfox?hc_ref=ARQY9qmSvyzCa8619RpZVtAj0lvD3YzpNX8t8k1b-clC4wiqOL5hq3xLBtFO0ACuNBI&fref=nf&hc_location=group Media inquiries may follow.

Deadline: Anticipatory

Recommendation: Email response. Science spokes not available today.

Approved by: Simon Jones, Mark Higgins, Carmel Lowe

Media lines:

- Herring die-offs are not unusual at this time of year as the weather warms up and ocean temperatures rise, creating ideal conditions for viral diseases and algae blooms.
- Sea lice are a naturally occurring ocean parasite that affect many species of fish, including herring. Sea lice do not generally cause mortality in herring.
- Fisheries and Oceans Canada (DFO) staff will visit the site and collect samples that will be used to study the cause of this mortality event.

Waddington, Zac

From: Waddington, Zac
Sent: June-25-18 4:55 PM
To: [REDACTED]
Cc: Keith, Ian; [REDACTED]
Subject: RE: Certification investigation into Sea Lice exceedance in Clayoquot Sound

Sounds good. Just let me know when, and where to call.

Zac

From: [REDACTED]
Sent: June-25-18 3:14 PM
To: Waddington, Zac
Cc: Keith, Ian; [REDACTED]
Subject: RE: Certification investigation into Sea Lice exceedance in Clayoquot Sound

Hi Zac,

Ok we will try and set up for Wednesday Morning to start with. We will send you an invite along with the call in info.

Thanks

CERMAQ

Phone +1 250-286-0022
Direct +1 250-286-0022 ext. [REDACTED]
Mobile +1 250-202-5291

Cermaq Canada Ltd.
#203-919 Island Highway
V9W 2C2 Campbell River, BC, Canada

Cermaq.ca [Facebook](#) [Twitter](#)

From: "Waddington, Zac" <Zac.Waddington@dfo-mpo.gc.ca>
To: [REDACTED]
Cc: "Keith, Ian" <Ian.Keith@dfo-mpo.gc.ca>, [REDACTED]
Date: 25/06/2018 03:05 PM
Subject: RE: Certification investigation into Sea Lice exceedance in Clayoquot Sound

s.19(1)

I can make before 9 am work most days this week, and my most open morning is Wednesday. Would it work to have a call Wednesday morning at some point that works for everyone?

Zac

From: [REDACTED]
Sent: June-25-18 9:02 AM
To: Waddington, Zac
Cc: Keith, Ian; [REDACTED]
Subject: RE: Certification investigation into Sea Lice exceedance in Clayoquot Sound

Hi Zac,

Thanks for getting back. The investigator is back in Ireland so we will likely have to make it a morning call to account for the time difference.

So we can start scheduling a time, is there any morning that does not work for you ?

Thanks



CERMAQ

Phone +1 250-286-0022
Direct +1 250-286-0022 ext. [REDACTED]
Mobile +1 250-202-5291

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#203-919 Island Highway
V9W 2C2 Campbell River, BC, Canada

Cermaq.ca [Facebook](#) [Twitter](#)

From: "Waddington, Zac" <Zac.Waddington@dfo-mpo.gc.ca>
To: [REDACTED], "Keith, Ian" <Ian.Keith@dfo-mpo.gc.ca>
Date: 25/06/2018 08:03 AM
Subject: RE: Certification investigation into Sea Lice exceedance in Clayoquot Sound

Sorry for my delayed response, [REDACTED] We would be willing to chat with the SAI folks this week if that's still of interest. Can you suggest a time to have a teleconference?

Zac

From: [REDACTED]
Sent: June-21-18 5:47 PM
To: Waddington, Zac; Keith, Ian
Subject: Certification investigation into Sea Lice exceedance in Clayoquot Sound

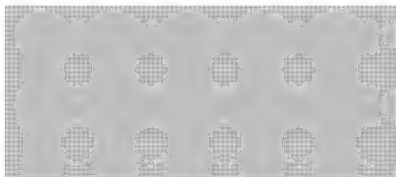
s.19(1)

Hello Zac and Ian,


We are currently undergoing an investigation led by SAI Global into the sea lice exceedance at our sites in the Clayoquot. As you are aware due to the elevated sea lice we suspended our ASC certifications at a number of our sites and the investigation by SAI is looking at the sea lice issue to determine if Certification can be re instated or not. The investigator is hoping that he could talk to either of you as the Regulator to get you take on what has happened. We are hoping that one/or both of you may be available for a teleconference tomorrow.

Please let me know if you are available and we can schedule a time.

Many thanks,



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Mobile +1 250-202-5291

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Higgins, Mark

From: Forrest, Robyn
Sent: June-26-18 9:32 AM
To: Higgins, Mark; Holmes, John; Cleary, Jaclyn; Jones, Simon
Cc: Thompson, Matthew
Subject: RE: Juvenile Herring Dying in Hot Springs Cove covered with Sea Lice

Thank you Mark. So perhaps an update could be (in green):

Dead and dying juvenile herring have been reported in Hot Springs Cove on the west coast of Vancouver Island. Visual examination of 22 dead and nearly dead herring floating on the surface by Nuuchah-nulth Tribal Council biologists showed that the fish ~~were covered~~ had high levels of ~~with~~ sea lice. Water samples along with checks of water temperature, dissolved oxygen and salinity were also made. Sea lice are known to be present at some Cermaq fish farm sites in the area, although the source of the sea lice in this case is not known. Staff in the Herring program and Aquatic Animal Health program were contacted and arranged for the collection and transfer of 27 herring to PBS where they will be checked for disease agents, and Sea Lice taken from the specimens will be identified to species to see if these are in fact the same lice that are found on salmon farms ~~in attempt to ascertain whether one or more of the nearby aquaculture sites are the source(s) of these parasites~~. This work has only begun, results are not yet available. Subsequent attempts to collect samples by C&P officers have so far failed to find any more occurrences. The West Coast Vancouver Island Herring stock has been closed to fishing owing to low biomass levels for several years. Given the high profile of Herring, Sea Lice and aquaculture there will likely be high interest in the findings in Nuuchah-nulth communities and the public in general.

From: Higgins, Mark
Sent: Tuesday, June 26, 2018 8:35 AM
To: Forrest, Robyn; Holmes, John; Cleary, Jaclyn; Jones, Simon
Cc: Thompson, Matthew
Subject: RE: Juvenile Herring Dying in Hot Springs Cove covered with Sea Lice


I have made some changes to the paragraph below in red. Not sure if we will find any more herring, I was in contact with Robert Kaatz last week (C&P) and he sent some staff out to try and collect samples for me. They came up empty, so I am thinking that the event has passed. He did mention that there were signs of an algae bloom, so that may also be a contributing factor in this.

Mark.

From: Forrest, Robyn
Sent: June-25-18 5:28 PM
To: Holmes, John; Cleary, Jaclyn; Jones, Simon
Cc: Higgins, Mark; Thompson, Matthew
Subject: RE: Juvenile Herring Dying in Hot Springs Cove covered with Sea Lice

Thanks John

Mark: is there anything to add to John's paragraph below? I am not informed about the sea lice issue wrt aquaculture or fish health.

John: a potential question from the public or media is about plans to monitor the situation. Should I contact  (NTC) to ask if they plan to look for any more samples? Similarly, do DFO plan to do any more monitoring of this? I don't think this is something the Herring program would do but I am cc'ing Matt Thompson just in case.

From: Holmes, John
Sent: Monday, June 25, 2018 5:16 PM

s.19(1)

To: Forrest, Robyn; Cleary, Jaclyn; Jones, Simon
Cc: Higgins, Mark
Subject: RE: Juvenile Herring Dying in Hot Springs Cove covered with Sea Lice

Given the high profile of herring, sea lice, and aquaculture separately, combined with FN interests, I think something needs to be put forward this week as a heads up, we don't need to have results yet. It doesn't matter to me who does it, just that it gets done. I am prepared to assist and put the paragraph forward to Carmel, but will need something such as below.

Dead and dying juvenile herring have been reported in Hot Springs Cove on the west coast of Vancouver Island. Visual examination of 22 dead and nearly dead herring floating on the surface by Nuuchah-nulth Tribal Council biologists showed that the fish were covered had high levels of with sea lice. Water samples along with checks of water temperature, dissolved oxygen and salinity were also made. Sea lice are known to be present at some Cermaq fish farm sites in the area. Staff in the Herring program and Aquatic Animal Health program were contacted and arranged for the collection and transfer of 27 herring to PBS where they will be checked for disease agents, and Sea Lice taken from the specimens will be identified to species to see if these are in fact the same lice that are found on salmon farms in attempt to ascertain whether one or more of the nearby aquaculture sites are the source(s) of these parasites. This work has only begun, results are not yet available. The West Coast Vancouver Island Herring stock has been closed to fishing owing to low biomass levels for several years. Given the high profile of Herring, Sea Lice and aquaculture there will likely be high interest in the findings in Nuuchah-nulth communities and the public in general.

John

(250) 756-7145
John.Holmes@dfo-mpo.gc.ca

From: Forrest, Robyn
Sent: June-25-18 4:27 PM
To: Holmes, John; Cleary, Jaclyn; Jones, Simon
Cc: Higgins, Mark
Subject: RE: Juvenile Herring Dying in Hot Springs Cove covered with Sea Lice

Hi John

I just realized that Jaclyn is out of the office. I think this is something that could be covered by AAH, especially Mark now has the samples.

Please confirm.

Robyn

From: Holmes, John
Sent: Monday, June 25, 2018 1:29 PM
To: Cleary, Jaclyn; Jones, Simon
Cc: Taylor, Nathan; Forrest, Robyn
Subject: RE: Juvenile Herring Dying in Hot Springs Cove covered with Sea Lice

Hi Jaclyn,

This is something that send forward as a "heads-up" through the ROCS (Regional Operations Center) bulletin system – ROCS items are short paragraphs intended to alert senior managers (RMC and extended RMC) to developing and ongoing issues and success stories. This item on herring and sea lice seems as if it would be important to highlight given the FN interest and the potential aquaculture tie-in.

Please put together a short paragraph using the guidelines below and forward to me by COB tomorrow (Tuesday June 26)

- 1 paragraph - make the first sentence the summary for of the issue so that it can stand along in case it is the only sentence read;
- describe issue - Keep the description short and to the point: what does the DM/MO care about? What is the problem, are we working on it, is it going to get better or worse?
- describe mitigating actions
- Provide a brief summary of the implications – i.e., address the “so what” question;
- use plain language, no acronyms, no technical jargon. Write simply and clearly;

Thanks,

John

(250) 756-7145
John.Holmes@dfo-mpo.gc.ca

From: Cleary, Jaclyn
Sent: June-22-18 11:47 AM
To: Kyle P Hebert; Jones, Simon
Cc: Taylor, Nathan; Holmes, John; Forrest, Robyn
Subject: Fwd: Juvenile Herring Dying in Hot Springs Cove covered with Sea Lice
Importance: High

Simon, Kyle,

One of our First Nations collaborators has collected some samples of herring with sea lice. Is there a way to identify whether these lice are from neighbouring salmon farms (see thread below). I've committed to sending a more thorough response and I'm needing some direction from one/ both of you.

Thanks,
Jaclyn

s.19(1)
s.21(1)(b)

Jaclyn Cleary

Program Head- Pacific Herring
Quantitative Assessment Methods Section (QAMS)
Stock Assessment and Research Division, Science
Fisheries and Oceans Canada, Government of Canada
Email: Jaclyn.Cleary@dfo-mpo.gc.ca / Tel: 250-756-7321

Section de méthode d'évaluation quantitatif (SMEQ)
Division de l'évaluation des stocks et de la recherche, Science
Pêches et océans Canada, Gouvernement du Canada
Email: Jaclyn.Cleary@dfo-mpo.gc.ca / Tél: 250-756-7321

Begin forwarded message:

From: Jaclyn Cleary <Jaclyn.Cleary@dfo-mpo.gc.ca>
Subject: Re: Juvenile Herring Dying in Hot Springs Cove covered with Sea Lice
Date: June 22, 2018 at 11:41:45 AM PDT
To:

Cc: [REDACTED]
[REDACTED]
Matthew Thompson <Matthew.Thompson@dfo-mpo.gc.ca>

Hi [REDACTED]
I've sent some inquiries within my department and will get back to you with a more thorough response. Please label the samples (location, date, time, sample method) and keep frozen.

~Jaclyn

Jaclyn Cleary

Program Head- Pacific Herring
Quantitative Assessment Methods Section (QAMS)
Stock Assessment and Research Division, Science
Fisheries and Oceans Canada, Government of Canada
Email: Jaclyn.Cleary@dfo-mpo.gc.ca / Tel: 250-756-7321

Section de méthode d'évaluation quantitatif (SMEQ)
Division de l'évaluation des stocks et de la recherche, Science
Pêches et océans Canada, Gouvernement du Canada
Email: Jaclyn.Cleary@dfo-mpo.gc.ca / Tél: 250-756-7321

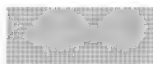
On Jun 21, 2018, at 5:23 PM, [REDACTED] wrote:

Hi Jaclyn,

[REDACTED] called me yesterday to report hundreds of juvenile herring dying in Hot Springs Cove that are covered with sea lice. The photo he originally sent me is "herring morts with sea lice HSC" that has the 3 samples he collected. I went up there today to collect samples [REDACTED] from the Cedarcoast Research station. We collected 22 samples of partially dead and dead herring floating on the surface that were absolutely littered with sea lice. We also collected some water samples along with checking temperature, DO, and salinity with his YSI. There is a sea lice epidemic occurring at some Cermaq fish farm sites that we have documented spreading to the wild salmon. (Juvenile Salmon photo). For example, [REDACTED] beach seining of juveniles around Vargas found salmon smolts with over 30 lice attached and even one coho smolt with over 50. The one fish farm found in Ross Passage has an average of 34 adult sea lice per fish!!! These levels of sea lice are unprecedented and is extremely disconcerting now that we see it's impacting WCVI herring.

We are wondering if you would like these samples or know of someone we should send them to within the department.

Sincerely,



<image005.jpg>



Uu-a-thluk Fisheries, Nuu-chah-nulth Tribal Council
P: 250-725-3899 | C: [REDACTED]

<image006.png>

s.19(1)

TF: 1-844-725-3899
PO BOX 1108, Tofino, BC V0R 2Z0

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<Herring Morts with Sea Lice HSC 2.jpg><Herring Morts with Sea Lice HSC 3.jpg><Herring Morts with Sea Lice HSC 4.jpg><Herring Morts with Sea Lice HSC.jpg><Juvenile salmon covered in sea lice.jpg>

No information has been removed or severed from this page

Waddington, Zac

From: Waddington, Zac
Sent: June-26-18 9:46 AM
To: Doucette, Claire
Subject: Sea lice Clayquot

I'm curious what the status of C and P's investigation into the sea lice exceedances in Clayoquot is. I have a phone meeting tomorrow morning with a third party ASC auditor curious about the regulatory perspective on this issue.

Dr. Zac Waddington DVM, B.Env.Sc.(Hons)
Lead Veterinarian - Pacific Region
Fisheries and Oceans Canada | Pêches et Océans Canada
Aquaculture Environmental Operations - Fish Health
Courtenay, British Columbia
Telephone | Téléphone: 250-703-0902
Fax | Télécopieur: 250-703-0921
Zac.Waddington@dfo-mpo.gc.ca

Sandberg, Krista

From: Sandberg, Krista
Sent: July-03-18 8:53 AM
To: 'Gautam, Raju (CFIA/ACIA)'
Cc: Waddington, Zac
Subject: RE: Slice treatment data
Attachments: Sea Lice Data Checked by Krista.csv

Hi Raju,

[REDACTED] I've checked the sea lice file and flagged the treatments that are duplicative and need to be removed. I also looked at the Sonora issue, and I believe you are correct – these should have been logged as Facility 380, not 211.

Cheers,
Krista.

Krista Sandberg
Office | Bureau 250-286-5835
Cellular | Cellulaire [REDACTED]



Government
of Canada

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du Canada

Canada

From: Gautam, Raju (CFIA/ACIA) [<mailto:raju.gautam@canada.ca>]
Sent: June-29-18 2:55 PM
To: Sandberg, Krista
Cc: Waddington, Zac
Subject: Slice treatment data

Hi Krista,
Here is the slice treatment data attached for you check and complete for treatment failure and/or resistance.
Raju

Raju Gautam

Epidemiologist, Aquatic Surveillance and Epidemiology Section
Canadian Food Inspection Agency / Government of Canada
raju.gautam@canada.ca / Tel: 613-773-6764

épidémiologiste, Section aquatique de surveillance et d'épidémiologie
Agence canadienne d'inspection des aliments / Gouvernement du Canada
raju.gautam@canada.ca / Tel: 613-773-6764

s.16(2)(c)

s.19(1)

Company	SiteREF	Facility	Nan LandfileNo	FishHealth	CalendarM	Species	BroodProd	Year	Therapeut	WeightActi	FishHealth	Occurrence	Mitigative	Dosage	uni.id
Marine Har	1338	2km NE of	1403748	2.4	NOV	Atlantic Sal Production	2012	Emamectin							1338NOV2012
Marine Har	1338	2km NE of	1403748	2.4	MAY	Atlantic Sal Production	2013	Emamectin	0.55275						1338MAY2013
Marine Har	1338	2km NE of	1403748	2.4	MAR	Atlantic Sal Production	2014	Emamectin	0.11697						1338MAR2014
Marine Har	1338	2km NE of	1403748	2.4	NOV	Atlantic Sal Production	2014	Emamectin	0.65						1338NOV2014
Grieg Seafc	1698	Ahlstrom P	2408042	3.1	APR	Atlantic Sal Production	2011	Emamectin							1698APR2011
Grieg Seafc	1698	Ahlstrom P	2408042	3.1	FEB	Atlantic Sal Production	2014	Emamectin	0.0731						1698FEB2014
Grieg Seafc	1698	Ahlstrom P	2408042	3.1	OCT	Atlantic Sal Production	2015	Emamectin	0.329						1698OCT2015
Grieg Seafc	1698	Ahlstrom P	2408042	3.1	JUN	Atlantic Sal Production	2016	Emamectin	0.228						1698JUN2016
Grieg Seafc	1698	Ahlstrom P	2408042	3.1	FEB	Atlantic Sal Production	2018	Emamectin	0.28	Event	New *	All pens tre	.05mg/Kg/i		1698FEB2018
Marine Har	1300	Althorpe, S	1407426	3.3	OCT	Atlantic Sal Production	2011	Emamectin							1300OCT2011
Marine Har	1300	Althorpe, S	1407426	3.3	APR	Atlantic Sal Production	2012	Emamectin							1300APR2012
Marine Har	1300	Althorpe, S	1407426	3.3	APR	Atlantic Sal Production	2015	Emamectin	0.73722						1300APR2015
Marine Har	1300	Althorpe, S	1407426	3.3	DEC	Atlantic Sal Production	2015	Emamectin	1.3446						1300DEC2015
Marine Har	1300	Althorpe, S	1407426	3.3	JAN	Atlantic Sal Production	2017	Emamectin	0.505499	Event	New *	All pens tre	0.1mg/kg;		1300JAN2017
Marine Har	1300	Althorpe, S	1407426	3.3	JAN	Atlantic Sal Production	2017	Emamectin	0.005019	Event	New *	Affected pr	0.06mg/kg		1300OCT2017
Marine Har	1300	Althorpe, S	1407426	3.3	OCT	Atlantic Sal Production	2017	Emamectin	0.826114	Event	New *	Affected pr	0.07mg/kg		1300NOV2017
Grieg Seafc	1738	Atrevida P	1411084	2.4	DEC	Atlantic Sal Production	2011	Emamectin							1738DEC2011
Grieg Seafc	1738	Atrevida P	1411084	2.4	AUG	Atlantic Sal Production	2015	Emamectin	0.3358						1738AUG2015
Cermaq Ca	1537	Bare Bluff,	1403979	2.3	SEP	Atlantic Sal Production	2011	Emamectin							1537SEP2011
Cermaq Ca	1537	Bare Bluff,	1403979	2.3	MAR	Atlantic Sal Production	2016	Emamectin	0.1474						1537MAR2016
Cermaq Ca	1537	Bare Bluff,	1403979	2.3	APR	Atlantic Sal Production	2016	Emamectin	0.3554						1537APR2016
Grieg Seafc	871	Barnes Bay	1405542	3.2	FEB	Atlantic Sal Production	2012	Emamectin							871FEB2012
Grieg Seafc	871	Barnes Bay	1405542	3.2	AUG	Atlantic Sal Production	2014	Emamectin	0.4484						871AUG2014
Grieg Seafc	871	Barnes Bay	1405542	3.2	NOV	Atlantic Sal Production	2014	Emamectin	0.2975						871NOV2014
Grieg Seafc	871	Barnes Bay	1405542	3.2	DEC	Atlantic Sal Production	2014	Emamectin	0.6039						871DEC2014
Grieg Seafc	871	Barnes Bay	1405542	3.2	OCT	Atlantic Sal Production	2015	Emamectin	0.26						871OCT2015
Grieg Seafc	871	Barnes Bay	1405542	3.2	MAY	Atlantic Sal Production	2016	Emamectin	0.5558						871MAY2016
Grieg Seafc	871	Barnes Bay	1405542	3.2	NOV	Atlantic Sal Production	2017	Emamectin	0.439	Event	New *	All pens tre	0.05mg/kg		871NOV2017
Cermaq Ca	227	Bawden Pc	1403647	2.3	OCT	Atlantic Sal Production	2011	Emamectin							227OCT2011
Cermaq Ca	227	Bawden Pc	1403647	2.3	MAY	Atlantic Sal Production	2014	Emamectin	0.537						227MAY2014
Cermaq Ca	227	Bawden Pc	1403647	2.3	SEP	Atlantic Sal Production	2015	Emamectin	0.092						227SEP2015
Cermaq Ca	227	Bawden Pc	1403647	2.3	FEB	Atlantic Sal Production	2016	Emamectin	0.3311						227FEB2016
Cermaq Ca	227	Bawden Pc	1403647	2.3	JUN	Atlantic Sal Production	2017	Emamectin	0.052	Event	New *	Affected pr	0.05mg/kg		227JUN2017
Cermaq Ca	227	Bawden Pc	1403647	2.3	FEB	Atlantic Sal Production	2018	Emamectin	0.38	Event	New *	All pens tre	0.05 mg/kg		227FEB2018
Cermaq Ca	520	Bedwell, E	1403980	2.3	SEP	Atlantic Sal Production	2011	Emamectin							520SEP2011
Cermaq Ca	520	Bedwell, E	1403980	2.3	JUL	Atlantic Sal Production	2015	Emamectin	0.295						520JUL2015
Cermaq Ca	520	Bedwell, E	1403980	2.3	DEC	Atlantic Sal Production	2015	Emamectin	0.64						520DEC2015
Grieg Seafc	1825	Bennett Pc	1411154	3.3	FEB	Atlantic Sal Production	2013	Emamectin	0.3006						1825FEB2013
Grieg Seafc	1825	Bennett Pc	1411154	3.3	FEB	Atlantic Sal Production	2014	Emamectin	0.039						1825FEB2014
Grieg Seafc	1825	Bennett Pc	1411154	3.3	DEC	Atlantic Sal Production	2014	Emamectin	0.38948						1825DEC2014
Cermaq Ca	1148	Binns Islan	1406648	2.3	MAY	Atlantic Sal Production	2011	Emamectin							1148MAY2011
Cermaq Ca	1148	Binns Islan	1406648	2.3	MAR	Atlantic Sal Production	2016	Emamectin	0.0777						1148MAR2016
Cermaq Ca	1148	Binns Islan	1406648	2.3	APR	Atlantic Sal Production	2017	Emamectin	0.518	Event	New *	Affected pr	0.058mg/k		1148APR2017
Cermaq Ca	1401	Brent Islan	1407983	3.2	SEP	Atlantic Sal Production	2011	Emamectin							1401SEP2011
Cermaq Ca	1401	Brent Islan	1407983	3.2	MAR	Atlantic Sal Production	2012	Emamectin							1401MAR2012
Cermaq Ca	1401	Brent Islan	1407983	3.2	AUG	Atlantic Sal Production	2013	Emamectin	0.11						1401AUG2013
Cermaq Ca	1401	Brent Islan	1407983	3.2	FEB	Atlantic Sal Production	2014	Emamectin	0.43						1401FEB2014
Cermaq Ca	1401	Brent Islan	1407983	3.2	JUL	Atlantic Sal Production	2014	Emamectin	0.94435						1401JUL2014
Cermaq Ca	1401	Brent Islan	1407983	3.2	SEP	Atlantic Sal Production	2015	Emamectin	0.199						1401SEP2015
Cermaq Ca	1401	Brent Islan	1407983	3.2	MAR	Atlantic Sal Production	2016	Emamectin	0.1965						1401MAR2016
Cermaq Ca	1401	Brent Islan	1407983	3.2	APR	Atlantic Sal Production	2016	Emamectin	0.9965						1401APR2016
Cermaq Ca	1401	Brent Islan	1407983	3.2	NOV	Atlantic Sal Production	2017	Emamectin	0.3479	Event	New *	All pens tre	0.05 mg/kg		1401NOV2017
Cermaq Ca	1144	Burdwood	1406650	3.3	FEB	Atlantic Sal Production	2012	Emamectin							1144FEB2012
Cermaq Ca	1144	Burdwood	1406650	3.3	NOV	Atlantic Sal Production	2013	Emamectin	0.584						1144NOV2013
Cermaq Ca	1144	Burdwood	1406650	3.3	MAY	Atlantic Sal Production	2015	Emamectin	0.542						1144MAY2015
Cermaq Ca	1144	Burdwood	1406650	3.3	JAN	Atlantic Sal Production	2017	Emamectin	0.575	Event	New *	All pens tre	0.05mg/kg		1144JAN2017
Cermaq Ca	819	Cecil Island	1405181	3.3	JUN	Atlantic Sal Brood	2013	Emamectin	0.05						819JUN2013
Cermaq Ca	819	Cecil Island	1405181	3.3	APR	Atlantic Sal Brood	2015	Emamectin	0.124						819APR2015
Marine Har	790	Chancellor	1405245	3.2	MAY	Atlantic Sal Production	2011	Emamectin							790MAY2011
Marine Har	790	Chancellor	1405245	3.2	NOV	Atlantic Sal Production	2016	Emamectin	0.6089	Event	New *	All pens tre	0.07 mg EA		790NOV2016
Grieg Seafc	1789	Concepcior	1405634	2.4	DEC	Atlantic Sal Production	2011	Emamectin							1789DEC2011
Grieg Seafc	1789	Concepcior	1405634	2.4	OCT	Atlantic Sal Production	2013	Emamectin	0.28						1789OCT2013
Grieg Seafc	1789	Concepcior	1405634	2.4	MAR	Atlantic Sal Production	2015	Emamectin	0.17						1789MAR2015
Grieg Seafc	1789	Concepcior	1405634	2.4	AUG	Atlantic Sal Production	2015	Emamectin	0.3864						1789AUG2015
Grieg Seafc	1789	Concepcior	1405634	2.4	JAN	Atlantic Sal Production	2018	Emamectin	0.825	Event	New *	All pens tre	.05mg/Kg/i		1789JAN2018
Grieg Seafc	1697	Culloden P	2408043	3.1	APR	Atlantic Sal Production	2011	Emamectin							1697APR2011
Grieg Seafc	1697	Culloden P	2408043	3.1	OCT	Atlantic Sal Production	2015	Emamectin	0.161						1697OCT2015
Grieg Seafc	1697	Culloden P	2408043	3.1	JUN	Atlantic Sal Production	2016	Emamectin	0.34125						1697JUN2016
Grieg Seafc	1697	Culloden P	2408043	3.1	FEB	Atlantic Sal Production	2018	Emamectin	0.39	Event	New *	All pens tre	.05mg/Kg/i		1697FEB2018
Cermaq Ca	458	Cypress Hri	1405381	3.3	FEB	Atlantic Sal Brood	2017	Emamectin	0.028	Event	New *	Affected pr	0.05mg/kg		458FEB2017
Cermaq Ca	458	Cypress Hri	1405381	3.3	FEB	Atlantic Sal Brood	2017	Emamectin	0.058	Event	New *	Affected pr	0.05mg/kg		458FEB2017
Marine Har	733	Cyrus Rock	1406292	3.2	NOV	Atlantic Sal Production	2011	Emamectin							733NOV2011
Marine Har	733	Cyrus Rock	1406292	3.2	MAY	Atlantic Sal Production	2012	Emamectin							733MAY2012
Marine Har	733	Cyrus Rock	1406292	3.2	JAN	Atlantic Sal Production	2013	Emamectin	0.9697						733JAN2013
Cermaq Ca	234	Dixon Poin	1403293	2.3	MAY	Atlantic Sal Production	2013	Emamectin	0.118						234MAY2013
Cermaq Ca	234	Dixon Poin	1403293	2.3	OCT	Atlantic Sal Production	2015	Emamectin	0.506						234OCT2015
Cermaq Ca	234	Dixon Poin	1403293	2.3	JUN	Atlantic Sal Production	2017	Emamectin	0.389	Event	New *	Affected pr	0.05mg/kg		234JUN2017
Cermaq Ca	234	Dixon Poin	1403293	2.3	SEP	Atlantic Sal Production	2017	Emamectin	0.644	Event	New *	All pens tre	0.05 mg/kg		234SEP2017
Cermaq Ca	234	Dixon Poin	1403293	2.3	OCT	Atlantic Sal Production	2017	Emamectin	0.644	Event	New *	All pens tre	0.05 mg/kg		234OCT2017
Marine Har	1586	Doctor Isle	1408758	3.3	JAN	Atlantic Sal Production	2013	Emamectin	0.313						1586JAN2013

Marine Har	1586	Doctor Isle	1408758	3.3	FEB	Atlantic Sal Production	2015	Emamectin	0.446487				1586FEB2015
Marine Har	1586	Doctor Isle	1408758	3.3	MAY	Atlantic Sal Production	2016	Emamectin	0.0501				1586MAY2016
Marine Har	1586	Doctor Isle	1408758	3.3	FEB	Atlantic Sal Production	2017	Emamectin	0.538521	Event	New *	All pens tre 0.07mg/kg	1586FEB2017
Marine Har	1288	Doyle Island	1407325	3.4	SEP	Atlantic Sal Production	2012	Emamectin					1288SEP2012
Marine Har	1288	Doyle Island	1407325	3.4	DEC	Atlantic Sal Production	2014	Emamectin	0.381175				1288DEC2014
Marine Har	1288	Doyle Island	1407325	3.4	JUN	Atlantic Sal Production	2015	Emamectin	0.053496				1288JUN2015
Marine Har	1288	Doyle Island	1407325	3.4	JUL	Atlantic Sal Production	2015	Emamectin	0.867315				1288JUL2015
Marine Har	1288	Doyle Island	1407325	3.4	MAR	Atlantic Sal Production	2017	Emamectin	0.478	Event	New *	All pens tre 0.08mg/kg	1288MAR2017
Marine Har	1293	Duncan Isl	1407326	3.4	DEC	Atlantic Sal Production	2014	Emamectin	0.691812				1293DEC2014
Marine Har	1293	Duncan Isl	1407326	3.4	JUL	Atlantic Sal Production	2015	Emamectin	1.271718				1293JUL2015
Marine Har	1293	Duncan Isl	1407326	3.4	FEB	Atlantic Sal Production	2017	Emamectin	0.534688	Event	New *	All pens tre 0.075mg/k	1293FEB2017
Marine Har	1293	Duncan Isl	1407326	3.4	MAR	Atlantic Sal Production	2017	Emamectin	1.8246	Event	New *	All pens tre 0.075 mg/l	1293MAR2017
Grieg Seafc	1863	Esperanza,	1411181	2.4	AUG	Atlantic Sal Production	2014	Emamectin	0.2262				1863AUG2014
Grieg Seafc	1863	Esperanza,	1411181	2.4	DEC	Atlantic Sal Production	2014	Emamectin	0.65247				1863DEC2014
Grieg Seafc	1863	Esperanza,	1411181	2.4	SEP	Atlantic Sal Production	2016	Emamectin	0.4	Event	New *		1863SEP2016
Cermaq Ca	540	Fortune Ch	1403914	2.3	JUN	Atlantic Sal Production	2015	Emamectin	0.706				540JUN2015
Cermaq Ca	540	Fortune Ch	1403914	2.3	FEB	Atlantic Sal Production	2017	Emamectin	0.493	Event	New *	All pens tre 0.05mg/kg	540FEB2017
Marine Har	7053	Ghi ya, Bull	1414224	3.4	JUL	Atlantic Sal Production	2016	Emamectin	1.127439				0.08 7053JUL2016
Marine Har	7053	Ghi ya, Bull	1414224	3.4	OCT	Atlantic Sal Production	2017	Emamectin	0.584288	Event	New *	All pens tre 0.07 mg/kg	7053OCT2017
Marine Har	303	Glacial Cre	2402751	3.1	FEB	Atlantic Sal Brood	2016	Emamectin	0.053256				303FEB2016
Marine Har	303	Glacial Cre	2402751	3.1	FEB	Atlantic Sal Brood	2017	Emamectin	0.066904	Event	New *	All pens tre 0.09mg/kg	303FEB2017
Marine Har	821	Glacial Fall	1405180	3.3	DEC	Atlantic Sal Production	2011	Emamectin					821DEC2011
Marine Har	821	Glacial Fall	1405180	3.3	JAN	Atlantic Sal Production	2014	Emamectin	0.27825				821JAN2014
Marine Har	821	Glacial Fall	1405180	3.3	JUN	Atlantic Sal Production	2015	Emamectin	0.146709				821JUN2015
Marine Har	821	Glacial Fall	1405180	3.3	FEB	Atlantic Sal Production	2016	Emamectin	0.70602				821FEB2016
Marine Har	821	Glacial Fall	1405180	3.3	JUN	Atlantic Sal Production	2016	Emamectin	0.001338				821JUN2016
Marine Har	821	Glacial Fall	1405180	3.3	MAR	Atlantic Sal Production	2018	Emamectin	0.55352	Event	New *	All pens tre 0.08mg/kg	821MAR2018
Marine Har	1702	Goat Cove,	6407324	3.5	OCT	Atlantic Sal Production	2011	Emamectin					1702OCT2011
Marine Har	1702	Goat Cove,	6407324	3.5	MAY	Atlantic Sal Production	2012	Emamectin					1702MAY2012
Marine Har	1702	Goat Cove,	6407324	3.5	OCT	Atlantic Sal Production	2012	Emamectin					1702OCT2012
Marine Har	1702	Goat Cove,	6407324	3.5	JAN	Atlantic Sal Production	2014	Emamectin	0.52836				1702JAN2014
Marine Har	1702	Goat Cove,	6407324	3.5	NOV	Atlantic Sal Production	2015	Emamectin	0.7315				1702NOV2015
Marine Har	1702	Goat Cove,	6407324	3.5	MAY	Atlantic Sal Production	2016	Emamectin	1.05672				1702MAY2016
Marine Har	892	Goletas Ch	1404918	3.4	NOV	Atlantic Sal Production	2011	Emamectin					892NOV2011
Marine Har	892	Goletas Ch	1404918	3.4	NOV	Atlantic Sal Production	2013	Emamectin	0.143395				892NOV2013
Marine Har	892	Goletas Ch	1404918	3.4	NOV	Atlantic Sal Production	2014	Emamectin	0.1984				892NOV2014
Grieg Seafc	1762	Gore Islanc	1411100	2.4	OCT	Atlantic Sal Production	2017	Emamectin	0.821	Event	New *	All pens tre 0.05mg/kg	1762OCT2017
Marine Har	1581	Hardwicke	1409321	3.2	MAY	Atlantic Sal Production	2011	Emamectin					1581MAY2011
Marine Har	1581	Hardwicke	1409321	3.2	JAN	Atlantic Sal Production	2013	Emamectin	0.241				1581JAN2013
Marine Har	1581	Hardwicke	1409321	3.2	DEC	Atlantic Sal Production	2013	Emamectin	1.1322				1581DEC2013
Marine Har	1581	Hardwicke	1409321	3.2	JAN	Atlantic Sal Production	2015	Emamectin	0.0629				1581JAN2015
Marine Har	1581	Hardwicke	1409321	3.2	APR	Atlantic Sal Production	2015	Emamectin	0.88243				1581APR2015
Marine Har	1581	Hardwicke	1409321	3.2	DEC	Atlantic Sal Production	2015	Emamectin	1.61376				1581DEC2015
Marine Har	1581	Hardwicke	1409321	3.3	NOV	Atlantic Sal Production	2016	Emamectin	0.537891		New *	All pens tre 0.08 mg EA	1581NOV2016
Marine Har	1618	Humphrey	1409707	3.3	DEC	Atlantic Sal Production	2011	Emamectin					1618DEC2011
Marine Har	1618	Humphrey	1409707	3.3	JAN	Atlantic Sal Production	2014	Emamectin	1.09446				1618JAN2014
Marine Har	1618	Humphrey	1409707	3.3	FEB	Atlantic Sal Production	2016	Emamectin	0.145991				1618FEB2016
Marine Har	1618	Humphrey	1409707	3.3	MAR	Atlantic Sal Production	2016	Emamectin	1.215291				1618MAR2016
Marine Har	1618	Humphrey	1409707	3.3	MAR	Atlantic Sal Production	2018	Emamectin	0.870422	Event	New *	All pens tre 0.08mg/kg	1618MAR2018
Marine Har	1580	Jackson Pa	6406814	3.5	OCT	Atlantic Sal Production	2014	Emamectin	0.028174				1580OCT2014
Marine Har	1691	Kid Bay, Ro	6406984	3.5	OCT	Atlantic Sal Production	2011	Emamectin	0.309				1691OCT2011
Marine Har	1691	Kid Bay, Ro	6406984	3.5	APR	Atlantic Sal Production	2012	Emamectin	0.309				1691APR2012
Marine Har	1691	Kid Bay, Ro	6406984	3.5	SEP	Atlantic Sal Production	2013	Emamectin	0.309				1691SEP2013
Marine Har	1691	Kid Bay, Ro	6406984	3.5	JAN	Atlantic Sal Production	2014	Emamectin	0.80688				1691JAN2014
Marine Har	1691	Kid Bay, Ro	6406984	3.5	JUN	Atlantic Sal Production	2015	Emamectin	0.040181				1691JUN2015
Marine Har	1691	Kid Bay, Ro	6406984	3.5	JUL	Atlantic Sal Production	2015	Emamectin	0.4775				1691JUL2015
Marine Har	1691	Kid Bay, Ro	6406984	3.5	NOV	Atlantic Sal Production	2015	Emamectin	0.91299				1691NOV2015
Marine Har	144	Koskimo B	1401723	2.4	SEP	Atlantic Sal Production	2011	Emamectin					144SEP2011
Marine Har	144	Koskimo B	1401723	2.4	MAY	Atlantic Sal Production	2012	Emamectin					144MAY2012
Marine Har	144	Koskimo B	1401723	2.4	MAR	Atlantic Sal Production	2013	Emamectin	0.05				144MAR2013
Marine Har	144	Koskimo B	1401722	2.4	NOV	Atlantic Sal Production	2013	Emamectin	0.238216				144NOV2013
Marine Har	144	Koskimo B	1401722	2.4	FEB	Atlantic Sal Production	2014	Emamectin	0.90576				144FEB2014
Marine Har	144	Koskimo B	1401722	2.4	APR	Atlantic Sal Production	2015	Emamectin	0.2511				144APR2015
Marine Har	144	Koskimo B	1401722	2.4	NOV	Atlantic Sal Production	2017	Emamectin	1.526459		New *	All pens tre 0.09 mg/kg	144NOV2017
Marine Har	100	Lees Bay, A	1401949	3.2	MAY	Atlantic Sal Production	2011	Emamectin					100MAY2011
Marine Har	100	Lees Bay, A	1401949	3.2	MAR	Atlantic Sal Production	2015	Emamectin	0.80584				100MAR2015
Marine Har	100	Lees Bay, A	1401949	3.2	JUN	Atlantic Sal Production	2016	Emamectin	0.000803				100JUN2016
Marine Har	100	Lees Bay, A	1401949	3.2	NOV	Atlantic Sal Production	2016	Emamectin	0.86292		New *	All pens tre 0.08 mg EA	100NOV2016
Marine Har	1896	Lime Bay, v	6407840	3.5	OCT	Atlantic Sal Production	2011	Emamectin					1896OCT2011
Marine Har	1896	Lime Bay, v	6407840	3.5	MAY	Atlantic Sal Production	2015	Emamectin	0.86				1896MAY2015
Marine Har	884	Lochalsh B	6403484	3.5	JAN	Atlantic Sal Production	2014	Emamectin	0.10881				884JAN2014
Marine Har	884	Lochalsh B	6403484	3.5	MAR	Atlantic Sal Production	2015	Emamectin	0.03013				884MAR2015
Marine Har	1338	Mahatta E	1403748	2.4	NOV	Atlantic Sal Production	2017	Emamectin	1.0251		New *	All pens tre 0.08 mg/kg	1338NOV2017
Marine Har	1238	Mahatta W	1406961	2.4	NOV	Atlantic Sal Production	2012	Emamectin	0.657504				1238NOV2012
Marine Har	1238	Mahatta W	1406961	2.4	APR	Atlantic Sal Production	2013	Emamectin	0.657504				1238APR2013
Marine Har	1238	Mahatta W	1406961	2.4	FEB	Atlantic Sal Production	2014	Emamectin	0.07524				1238FEB2014
Marine Har	1238	Mahatta W	1406961	2.4	NOV	Atlantic Sal Production	2014	Emamectin	0.43232				1238NOV2014
Marine Har	1351	Marsh Bay,	1407749	3.4	JUL	Atlantic Sal Production	2011	Emamectin					1351JUL2011
Marine Har	1351	Marsh Bay,	1407749	3.4	SEP	Atlantic Sal Production	2014	Emamectin	1.14757				1351SEP2014
Marine Har	1351	Marsh Bay,	1407749	3.4	NOV	Atlantic Sal Production	2015	Emamectin	0.28215				1351NOV2015
Marine Har	1351	Marsh Bay,	1407749	3.4	MAY	Atlantic Sal Production	2016	Emamectin	0.9817				1351MAY2016

Cermaq Ca	869 Maude Isla	1405739	3.3	MAR	Atlantic Sal Production	2013	Emamectin	0.1973				869MAR2013
Cermaq Ca	869 Maude Isla	1405739	3.3	FEB	Atlantic Sal Production	2017	Emamectin	0.447	Event	New *	All pens tre 0.05mg/kg	869FEB2017
Marine Har	467 Midsumme	1404380	3.3	NOV	Atlantic Sal Production	2011	Emamectin	0.32708				467NOV2011
Marine Har	467 Midsumme	1404380	3.3	FEB	Atlantic Sal Production	2014	Emamectin	0.32708				467FEB2014
Marine Har	467 Midsumme	1404380	3.3	FEB	Atlantic Sal Production	2015	Emamectin	1.23757				467FEB2015
Marine Har	467 Midsumme	1404380	3.3	FEB	Atlantic Sal Production	2016	Emamectin	0.60384				467FEB2016
Marine Har	467 Midsumme	1404380	3.3	FEB	Atlantic Sal Production	2017	Emamectin	0.085017	Event	New *	Affected pr 0.08mg/kg	467FEB2017
Marine Har	467 Midsumme	1404380	3.3	MAR	Atlantic Sal Production	2018	Emamectin	0.874912	Event	New *	All pens tre 0.09mg/kg	467MAR2018
Cermaq Ca	1507 Millar Char	1408719	2.3	MAY	Atlantic Sal Production	2013	Emamectin	0.056				1507MAY2013
Cermaq Ca	1507 Millar Char	1408719	2.3	AUG	Atlantic Sal Production	2013	Emamectin	0.254				1507AUG2013
Cermaq Ca	1507 Millar Char	1408719	2.3	MAY	Atlantic Sal Production	2014	Emamectin	0.386				1507MAY2014
Cermaq Ca	1507 Millar Char	1408719	2.3	SEP	Atlantic Sal Production	2015	Emamectin	0.399				1507SEP2015
Cermaq Ca	1507 Millar Char	1408719	2.3	APR	Atlantic Sal Production	2016	Emamectin	0.263				1507APR2016
Cermaq Ca	1507 Millar Char	1408719	2.3	MAY	Atlantic Sal Production	2016	Emamectin	0.808				1507MAY2016
Cermaq Ca	1507 Millar Char	1408719	2.3	MAY	Atlantic Sal Production	2017	Emamectin	0.249	Event	New *	All pens tre 0.05mg/kg	1507JUN2017
Cermaq Ca	1507 Millar Char	1408719	2.3	SEP	Atlantic Sal Production	2017	Emamectin	0.495	Event	New *	All pens tre 0.05 mg/kg	1507SEP2017
Marine Har	1237 Monday Rc	1406960	2.4	SEP	Atlantic Sal Production	2011	Emamectin					1237SEP2011
Marine Har	1237 Monday Rc	1406960	2.4	MAR	Atlantic Sal Production	2012	Emamectin					1237MAR2012
Marine Har	1237 Monday Rc	1406960	2.4	FEB	Atlantic Sal Production	2013	Emamectin	0.1338				1237FEB2013
Marine Har	1237 Monday Rc	1406960	2.4	NOV	Atlantic Sal Production	2013	Emamectin	0.513885				1237NOV2013
Marine Har	1237 Monday Rc	1406960	2.4	FEB	Atlantic Sal Production	2014	Emamectin	1.02309				1237FEB2014
Marine Har	1237 Monday Rc	1406960	2.4	APR	Atlantic Sal Production	2015	Emamectin	0.20793				1237APR2015
Marine Har	1237 Monday Rc	1406960	2.4	NOV	Atlantic Sal Production	2017	Emamectin	1.00307		New *	All pens tre 0.08 mg/kg	1237NOV2017
Grieg Seafc	1849 Muchalat li	1411168	2.4	SEP	Atlantic Sal Production	2014	Emamectin	0.2888				1849SEP2014
Grieg Seafc	1849 Muchalat li	1411168	2.4	FEB	Atlantic Sal Production	2015	Emamectin	0.78164				1849FEB2015
Grieg Seafc	1849 Muchalat li	1411168	2.4	MAR	Atlantic Sal Production	2015	Emamectin	0.79294				1849MAR2015
Grieg Seafc	1700 Muchalat li	1411064	2.4	JAN	Atlantic Sal Production	2013	Emamectin	0.525				1700JAN2013
Grieg Seafc	1700 Muchalat li	1411064	2.4	SEP	Atlantic Sal Production	2014	Emamectin	0.3367				1700SEP2014
Grieg Seafc	1700 Muchalat li	1411064	2.4	FEB	Atlantic Sal Production	2015	Emamectin	0.24928				1700FEB2015
Grieg Seafc	1700 Muchalat li	1411064	2.4	MAR	Atlantic Sal Production	2015	Emamectin	0.76928				1700MAR2015
Grieg Seafc	1700 Muchalat li	1411064	2.4	FEB	Atlantic Sal Production	2018	Emamectin	0.125	Event	New *	All pens tre .05mg/Kg/l	1700FEB2018
Grieg Seafc	1700 Muchalat li	1411064	2.4	MAR	Atlantic Sal Production	2018	Emamectin	0.44	Event	On-going *	All pens tre .05mg/kg/l	1700MAR2018
Cermaq Ca	543 Mussel Roc	1401589	2.3	AUG	Atlantic Sal Production	2011	Emamectin					543AUG2011
Cermaq Ca	543 Mussel Roc	1401589	2.3	JUL	Atlantic Sal Production	2013	Emamectin	0.305				543JUL2013
Cermaq Ca	543 Mussel Roc	1401589	2.3	JUL	Atlantic Sal Production	2015	Emamectin	0.313				543JUL2015
Cermaq Ca	543 Mussel Roc	1401589	2.3	DEC	Atlantic Sal Production	2015	Emamectin	0.704				543DEC2015
Cermaq Ca	543 Mussel Roc	1401589	2.3	MAY	Atlantic Sal Production	2017	Emamectin	0.201	Event	New *	All pens tre 0.05mg/kg	543MAY2017
Cermaq Ca	543 Mussel Roc	1401589	2.3	SEP	Atlantic Sal Production	2017	Emamectin	0.516	Event	New *	All pens tre 0.05 mg/kg	543SEP2017
Grieg Seafc	1825 Noo-La, Cli	1411154	3.3	FEB	Atlantic Sal Production	2017	Emamectin	0.7007	Event	New *	All pens tre 0.0143g/kg	1825FEB2017
Marine Har	78 Phillips Arn	2403170	3.2	JAN	Atlantic Sal Production	2013	Emamectin	0.761				78JAN2013
Marine Har	78 Phillips Arn	2403170	3.2	JAN	Atlantic Sal Production	2015	Emamectin	0.761231				78JAN2015
Marine Har	78 Phillips Arn	2403170	3.2	DEC	Atlantic Sal Production	2016	Emamectin	0.502272	Event	New *	All pens tre 0.08 mg/kg	78DEC2016
Cermaq Ca	6668 Plover Poir	1413555	2.3	SEP	Atlantic Sal Production	2015	Emamectin	0.165				6668SEP2015
Cermaq Ca	6668 Plover Poir	1413555	2.3	FEB	Atlantic Sal Production	2016	Emamectin	0.5208				6668FEB2016
Marine Har	141 Port Elizab	1403104	3.3	MAY	Atlantic Sal Production	2015	Emamectin	0.33				141MAY2015
Marine Har	141 Port Elizab	1403104	3.3	FEB	Atlantic Sal Production	2016	Emamectin	0.260195				141FEB2016
Marine Har	1145 Potts Bay, I	1406655	3.3	JAN	Atlantic Sal Brood	2013	Emamectin	0.05				1145JAN2013
Marine Har	1145 Potts Bay, I	1406655	3.3	JAN	Atlantic Sal Brood	2014	Emamectin	0.01258				1145JAN2014
Marine Har	1145 Potts Bay, I	1406655	3.3	NOV	Atlantic Sal Brood	2014	Emamectin	0.026038				1145NOV2014
Marine Har	1145 Potts Bay, I	1406655	3.3	APR	Atlantic Sal Brood	2015	Emamectin	0.068394				1145APR2015
Marine Har	1145 Potts Bay, I	1406655	3.3	JAN	Atlantic Sal Brood	2016	Emamectin	0.01887				1145JAN2016
Marine Har	1145 Potts Bay, I	1406655	3.3	FEB	Atlantic Sal Brood	2016	Emamectin	0.075				1145FEB2016
Marine Har	1145 Potts Bay, I	1406655	3.3	FEB	Atlantic Sal Brood	2017	Emamectin	0.04275	Event	New *	Affected pr 0.08mg/kg	1145FEB2017
Marine Har	1145 Potts Bay, I	1406655	3.3	DEC	Atlantic Sal Brood	2017	Emamectin	0.005043	Event	New *	All pens tre 0.08 mg/kg	1145DEC2017
Marine Har	1145 Potts Bay, I	1406655	3.3	DEC	Atlantic Sal Brood	2017	Emamectin	0.01762	Event	New *	Affected pr 0.10 mg/kg	1145DEC2017
Cermaq Ca	526 Rant Point,	1403262	2.3	JUN	Atlantic Sal Production	2011	Emamectin					526JUN2011
Cermaq Ca	526 Rant Point,	1403262	2.3	JUL	Atlantic Sal Production	2013	Emamectin	0.593				526JUL2013
Cermaq Ca	526 Rant Point,	1403262	2.3	MAY	Atlantic Sal Production	2015	Emamectin	0.628				526MAY2015
Cermaq Ca	526 Rant Point,	1403262	2.3	MAY	Atlantic Sal Production	2017	Emamectin	0.029	Event	New *	All pens tre 0.05mg/kg	526MAY2017
Cermaq Ca	526 Rant Point,	1403262	2.3	JUN	Atlantic Sal Production	2017	Emamectin	0.098	Event	On-going *	All pens tre 0.05mg/kg	526JUN2017
Cermaq Ca	526 Rant Point,	1403262	2.3	SEP	Atlantic Sal Production	2017	Emamectin	0.159	Event	New *	All pens tre 0.05 mg/kg	526SEP2017
Marine Har	1198 Raynor	NA	3.4	NOV	Atlantic Sal Production	2011	Emamectin					1198NOV2011
Marine Har	1198 Raynor	NA	3.4	OCT	Atlantic Sal Production	2012	Emamectin					1198OCT2012
Cermaq Ca	304 Raza Island	2403035	3.2	MAR	Atlantic Sal Production	2013	Emamectin	0.62832				304MAR2013
Cermaq Ca	304 Raza Island	2403035	3.2	JAN	Atlantic Sal Production	2017	Emamectin	0.045	Event	On-going *	Affected pr 0.05mg/kg	304JAN2017
Cermaq Ca	304 Raza Island	2403035	3.2	JAN	Atlantic Sal Production	2017	Emamectin	0.719	Event	New *	Affected pr 0.05mg/kg	304JAN2017
Cermaq Ca	314 Ross Pass,	1405933	2.3	OCT	Atlantic Sal Production	2011	Emamectin					314OCT2011
Cermaq Ca	314 Ross Pass,	1405933	2.3	MAY	Atlantic Sal Production	2013	Emamectin	0.109				314MAY2013
Cermaq Ca	314 Ross Pass,	1405933	2.3	SEP	Atlantic Sal Production	2013	Emamectin	0.37				314SEP2013
Cermaq Ca	314 Ross Pass,	1405933	2.3	OCT	Atlantic Sal Production	2015	Emamectin	0.409				314OCT2015
Cermaq Ca	314 Ross Pass,	1405933	2.3	FEB	Atlantic Sal Production	2016	Emamectin	0.684				314FEB2016
Cermaq Ca	314 Ross Pass,	1405933	2.3	JUN	Atlantic Sal Production	2017	Emamectin	0.228	Event	New *	Affected pr 0.05mg/kg	314JUN2017
Cermaq Ca	314 Ross Pass,	1405933	2.3	SEP	Atlantic Sal Production	2017	Emamectin	0.365	Event	New *	All pens tre 0.05 mg/kg	314SEP2017
Cermaq Ca	314 Ross Pass,	1405933	2.3	OCT	Atlantic Sal Production	2017	Emamectin	0.365	Event	New *	All pens tre 0.05 mg/kg	314OCT2017
Grieg Seafc	332 Salten, Nor	2402424	3.1	SEP	Atlantic Sal Production	2015	Emamectin	0.15692				332SEP2015
Grieg Seafc	332 Salten, Nor	2402424	3.1	APR	Atlantic Sal Production	2017	Emamectin	0.153094	Event	New *	All pens tre 0.05 mg/kg	332APR2017
Grieg Seafc	332 Salten, Nor	2402424	3.1	MAR	Atlantic Sal Production	2018	Emamectin	0.23	Event	New *	All pens tre .05mg/Kg/l	332MAR2018
Cermaq Ca	527 Saranac Isl	1401590	2.3	AUG	Atlantic Sal Production	2011	Emamectin					527AUG2011
Cermaq Ca	527 Saranac Isl	1401590	2.3	MAR	Atlantic Sal Production	2012	Emamectin					527MAR2012
Cermaq Ca	527 Saranac Isl	1401590	2.3	MAY	Atlantic Sal Production	2013	Emamectin	0.406				527MAY2013
Cermaq Ca	527 Saranac Isl	1401590	2.3	AUG	Atlantic Sal Production	2013	Emamectin	0.66				527AUG2013

Cermaq Ca	527	Saranac Isl	1401590	2.3	MAY	Atlantic Sal Production	2015	Emamectin	0.643				527MAY2015
Cermaq Ca	527	Saranac Isl	1401590	2.3	JUL	Atlantic Sal Production	2016	Emamectin	0.06	Event	New *	All pens tre 0.05mg/kg	527JUL2016
Cermaq Ca	527	Saranac Isl	1401590	2.3	JUN	Atlantic Sal Production	2017	Emamectin	0.208	Event	New *	Affected pe 0.05mg/kg	527JUN2017
Cermaq Ca	527	Saranac Isl	1401590	2.3	SEP	Atlantic Sal Production	2017	Emamectin	0.534	Event	New *	All pens tre 0.05 mg/kg	527SEP2017
Marine Har	1059	Sargeaunt I	1403328	3.3	JAN	Atlantic Sal Production	2012	Emamectin					1059JAN2012
Marine Har	1059	Sargeaunt I	1403328	3.3	JAN	Atlantic Sal Production	2014	Emamectin	1.3608				1059JAN2014
Marine Har	1059	Sargeaunt I	1403328	3.3	FEB	Atlantic Sal Production	2016	Emamectin	0.371336				1059FEB2016
Marine Har	1059	Sargeaunt I	1403328	3.3	MAR	Atlantic Sal Production	2016	Emamectin	1.7948				1059MAR2016
Marine Har	1059	Sargeaunt I	1403328	3.3	MAR	Atlantic Sal Production	2018	Emamectin	1.596614	Event	New *	All pens tre 0.09mg/kg	1059MAR2018
Marine Har	1895	Sheep Pass	6407839	3.5	FEB	Atlantic Sal Production	2013	Emamectin	1.0073				1895FEB2013
Marine Har	1895	Sheep Pass	6407839	3.5	MAY	Atlantic Sal Production	2013	Emamectin	1.3838				1895MAY2013
Marine Har	1895	Sheep Pass	6407839	3.5	OCT	Atlantic Sal Production	2013	Emamectin	0.234628				1895OCT2013
Marine Har	1895	Sheep Pass	6407839	3.5	NOV	Atlantic Sal Production	2013	Emamectin	1.1393				1895NOV2013
Marine Har	1895	Sheep Pass	6407839	3.5	OCT	Atlantic Sal Production	2014	Emamectin	0.63294				1895OCT2014
Marine Har	1895	Sheep Pass	6407839	3.5	JUN	Atlantic Sal Production	2016	Emamectin	0.37665				1895JUN2016
Marine Har	1895	Sheep Pass	6407839	3.5	JUN	Atlantic Sal Production	2017	Emamectin	1.097094	Event	New *	All pens tre 0.07 mg/kg	1895JUN2017
Marine Har	1350	Shelter Bay	1407748	3.4	NOV	Atlantic Sal Production	2011	Emamectin					1350NOV2011
Marine Har	1350	Shelter Bay	1407748	3.4	DEC	Atlantic Sal Production	2013	Emamectin	0.52041				1350DEC2013
Marine Har	1350	Shelter Bay	1407748	3.4	MAR	Atlantic Sal Production	2016	Emamectin	0.854434				1350MAR2016
Marine Har	831	Shelter Pas	1404091	3.4	DEC	Atlantic Sal Production	2011	Emamectin					831DEC2011
Marine Har	831	Shelter Pas	1404091	3.4	NOV	Atlantic Sal Production	2012	Emamectin					831NOV2012
Marine Har	831	Shelter Pas	1404091	3.4	OCT	Atlantic Sal Production	2014	Emamectin	0.316476				831OCT2014
Marine Har	831	Shelter Pas	1404091	3.4	MAR	Atlantic Sal Production	2017	Emamectin	0.544	Event	New *	All pens tre 0.07 mg/kg	831MAR2017
Cermaq Ca	728	Sir Edmunc	1404179	3.3	MAR	Atlantic Sal Production	2013	Emamectin	0.26854				728MAR2013
Cermaq Ca	728	Sir Edmunc	1404179	3.3	MAR	Atlantic Sal Production	2015	Emamectin	0.375				728MAR2015
Cermaq Ca	728	Sir Edmunc	1404179	3.3	FEB	Atlantic Sal Production	2017	Emamectin	0.713	Event	New *	All pens tre 0.05mg/kg	728FEB2017
Grieg Seafc	746	Site 13, Sec	2402591	3.1	SEP	Atlantic Sal Production	2015	Emamectin	0.074848				746SEP2015
Grieg Seafc	746	Site 13, Sec	2402591	3.1	MAR	Atlantic Sal Production	2018	Emamectin	0.087	Event	New *	All pens tre .05mg/Kg/i	746MAR2018
Marine Har	211	Sonora Isla	1403325	3.2	MAR	Atlantic Sal Production	2011	Emamectin					211MAR2011
Marine Har	211	Sonora Isla	1403325	3.2	AUG	Atlantic Sal Production	2011	Emamectin					211AUG2011
Marine Har	211	Sonora Isla	1403325	3.2	MAY	Atlantic Sal Production	2012	Emamectin					211MAY2012
Marine Har	211	Sonora Isla	1403325	3.2	JAN	Atlantic Sal Production	2013	Emamectin	0.277				211JAN2013
Marine Har	211	Sonora Isla	1403325	3.2	FEB	Atlantic Sal Production	2014	Emamectin	0.49062				211FEB2014
Marine Har	211	Sonora Isla	1403325	3.2	AUG	Atlantic Sal Production	2014	Emamectin	0.82455				211AUG2014
Marine Har	211	Sonora Isla	1403325	3.2	JAN	Atlantic Sal Production	2015	Emamectin	1.258901				211JAN2015
Marine Har	211	Sonora Isla	1403325	3.2	OCT	Atlantic Sal Production	2015	Emamectin	0.287035				211OCT2015
Marine Har	211	Sonora Isla	1403325	3.2	APR	Atlantic Sal Production	2016	Emamectin	0.80512				211APR2016
Marine Har	211	Sonora Isla	1403325	3.2	NOV	Atlantic Sal Production	2017	Emamectin	0.877073	Event	New *	All pens tre 0.08 mg/kg	211NOV2017
Marine Har	380	Sonora Pt.,	1403325	3.2	MAY	Atlantic Sal Production	2012	Emamectin					380MAY2012
Marine Har	380	Sonora Pt.,	1403144	3.2	JUN	Atlantic Sal Production	2014	Emamectin	0.875187				380JUN2014
Marine Har	380	Sonora Pt.,	1403144	3.2	FEB	Atlantic Sal Production	2015	Emamectin	0.002352				380FEB2015
Marine Har	380	Sonora Pt.,	1403144	3.2	DEC	Atlantic Sal Production	2015	Emamectin	0.9408				380DEC2015
Marine Har	380	Sonora Pt.,	1403144	3.2	DEC	Atlantic Sal Production	2016	Emamectin	0.495007	Event	New *	All pens tre 0.08 mg/kg	380DEC2016
Grieg Seafc	1079	Steamer Pc	1404969	2.4	AUG	Atlantic Sal Production	2014	Emamectin	0.1833				1079AUG2014
Grieg Seafc	1079	Steamer Pc	1404969	2.4	DEC	Atlantic Sal Production	2014	Emamectin	0.52143				1079DEC2014
Grieg Seafc	1079	Steamer Pc	1404969	2.4	SEP	Atlantic Sal Production	2016	Emamectin	0.3875	Event	New *		1079SEP2016
Marine Har	465	Swanson Is	1404381	3.3	JAN	Atlantic Sal Production	2013	Emamectin	0.213				465JAN2013
Marine Har	465	Swanson Is	1404381	3.3	NOV	Atlantic Sal Production	2013	Emamectin	1.076962				465NOV2013
Marine Har	465	Swanson Is	1404381	3.3	FEB	Atlantic Sal Production	2015	Emamectin	0.5585				465FEB2015
Marine Har	465	Swanson Is	1404381	3.3	JAN	Atlantic Sal Production	2017	Emamectin	0.658865	Event	New *	All pens tre 0.08mg/kg	465JAN2017
Grieg Seafc	221	Vantage Pc	2402095	3.1	SEP	Atlantic Sal Production	2015	Emamectin	0.11921				221SEP2015
Grieg Seafc	221	Vantage Pc	2402095	3.1	MAR	Atlantic Sal Production	2018	Emamectin	0.143	Event	New *	All pens tre .05mg/Kg/i	221MAR2018
Cermaq Ca	306	Venture Pc	1403267	3.2	SEP	Atlantic Sal Production	2011	Emamectin					306SEP2011
Cermaq Ca	306	Venture Pc	1403267	3.2	MAR	Atlantic Sal Production	2012	Emamectin					306MAR2012
Cermaq Ca	306	Venture Pc	1403267	3.2	AUG	Atlantic Sal Production	2013	Emamectin	0.075				306AUG2013
Cermaq Ca	306	Venture Pc	1403267	3.2	FEB	Atlantic Sal Production	2014	Emamectin	0.292				306FEB2014
Cermaq Ca	306	Venture Pc	1403267	3.2	JUL	Atlantic Sal Production	2014	Emamectin	0.83325				306JUL2014
Cermaq Ca	306	Venture Pc	1403267	3.2	SEP	Atlantic Sal Production	2015	Emamectin	0.218				306SEP2015
Cermaq Ca	306	Venture Pc	1403267	3.2	MAR	Atlantic Sal Production	2016	Emamectin	0.245				306MAR2016
Cermaq Ca	306	Venture Pc	1403267	3.2	APR	Atlantic Sal Production	2016	Emamectin	1.085				306APR2016
Cermaq Ca	306	Venture Pc	1403267	3.2	NOV	Atlantic Sal Production	2017	Emamectin	0.378	Event	New *	All pens tre 0.05 mg/kg	306NOV2017
Grieg Seafc	1839	Wa-kwa	1411170	3.3	FEB	Atlantic Sal Production	2017	Emamectin	0.35035	Event	New *	All pens tre 0.0143g/kg	1839FEB2017
Marine Har	7054	Wanx talis	1414225	3.4	DEC	Atlantic Sal Production	2017	Emamectin	0.474428	Event	New *	Affected pe 0.08mg/kg	7054DEC2017
Cermaq Ca	1472	West Side,	1408492	2.3	AUG	Atlantic Sal Production	2011	Emamectin					1472AUG2011
Cermaq Ca	1472	West Side,	1408492	2.3	MAY	Atlantic Sal Production	2016	Emamectin	0.165				1472MAY2016
Cermaq Ca	1472	West Side,	1408492	2.3	FEB	Atlantic Sal Production	2017	Emamectin	0.789	Event	New *	All pens tre 0.05mg/kg	1472FEB2017
Marine Har	820	Wicklow Pc	1405183	3.3	NOV	Atlantic Production	2014	Emamectin	0.264				820NOV2014
Marine Har	820	Wicklow Pc	1405183	3.3	JUL	Atlantic Production	2015	Emamectin	3.112312				820JUL2015
Marine Har	820	Wicklow Pc	1405183	3.3	JAN	Atlantic Sal Production	2017	Emamectin	0.517173	Event	New *	All pens tre 0.09mg/kg	820JAN2017
Marine Har	820	Wicklow Pc	1405183	3.3	OCT	Atlantic Sal Production	2017	Emamectin	0.823162	Event	New *	All pens tre 0.05 mg/kg	820OCT2017
Grieg Seafc	1705	Williamson	1411068	2.4	DEC	Atlantic Production	2011	Emamectin					1705DEC2011
Grieg Seafc	1705	Williamson	1411068	2.4	AUG	Atlantic Production	2015	Emamectin	0.098				1705AUG2015
Grieg Seafc	1705	Williamson	1411068	2.4	APR	Atlantic Sal Production	2016	Emamectin	0.705075				1705APR2016

Sandberg, Krista

From: Sandberg, Krista
Sent: July-04-18 1:03 PM
To: Waddington, Zac; 'Gautam, Raju (CFIA/ACIA)'
Subject: RE: refined SLICE use table
Attachments: Resistance Assessment - Krista.xlsx

I've added Ian's comments, though there are few.

I used the count 2 reporting months post treatment in all cases that I could. This was almost always lower than one month post treatment but often slightly higher than 3 months post treatment. Keep in mind that this is using reporting month, so the actual treatment could have occurred at the beginning or end of the month and the post treatment counts could have occurred at the beginning or end of the month, so we basically have a 2 month window in where the actual dates lie.

As for residual, when I have time, it would be interesting to add in the 4 month post-treatment count, where it exists as an indicator of residual. I suspect we may see a trend there as well. I think the overabundance notifications are pretty patchy, so don't know if they would be reliable.

Krista.

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Krista Sandberg

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From: Waddington, Zac
Sent: July-04-18 12:49 PM
To: Sandberg, Krista; 'Gautam, Raju (CFIA/ACIA)'
Subject: RE: refined SLICE use table

Excellent. So just to summarize so I understand: the pre-treatment count was the highest count in the month of (or preceding) the treatment, and the post-treatment count used was the lowest in the 2 months following treatment?? I am reading the Lees et al., 2008 paper currently, and they found that within 30 days most often lice levels fell below the 60% reduction, though occasionally it took up to 60 days. So if we use 2 months that should be sufficient.

It would be excellent if we could build in some measure of residual effect, but I suspect season would have a huge impact on that. Ideally, if the residual effect isn't long enough, we should expect to see another treatment occurring in a shorter time frame, and that would be captured in our existing dataset. I wonder if we could use sea lice over threshold notification data post-treatment to determine a rough proxy for residual effect?? What do you think??

Zac

From: Sandberg, Krista
Sent: July-04-18 12:42 PM
To: Waddington, Zac; 'Gautam, Raju (CFIA/ACIA)'
Subject: RE: refined SLICE use table

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Oh yes, I meant to mention that in my email. I used a general rule of 2 reporting months post-treatment. It's important to keep in mind that this is a snapshot general analysis. It's not based on concrete treatment dates, just a ballpark of the highest reported abundance pre-treatment month (could be that month or the month before), and then 2 reporting months after that for the post treatment count. I made notes when there were deviations. I noticed that quite often when there were suspected resistance issues, the first sign was that there was no residual, so even if a reasonable decrease in abundance occurred after treatment, the abundance went back up again very quickly, and often resulted in a second treatment with lesser effect.

I also realized that I didn't add in Ian's comments like I said I would. Doing that now...

Krista.

Krista Sandberg

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From: Waddington, Zac
Sent: July-04-18 12:30 PM
To: Sandberg, Krista; 'Gautam, Raju (CFIA/ACIA)'
Subject: RE: refined SLICE use table

Wow! Thanks very much Krista. What time frame did you put on the post-treatment counts? The Lees et al., 2008 paper defined it as <40% lice motile lice remaining at any point up to 13 weeks post treatment. Was that the same rule you applied?

Zac

From: Sandberg, Krista
Sent: July-04-18 11:53 AM
To: 'Gautam, Raju (CFIA/ACIA)'; Waddington, Zac
Subject: RE: refined SLICE use table

Please see attached. I hope this makes sense. Let me know if you have any questions ☺

Krista Sandberg

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From: Gautam, Raju (CFIA/ACIA) [mailto:raju.gautam@canada.ca]
Sent: July-04-18 10:31 AM
To: Sandberg, Krista; Waddington, Zac
Subject: RE: refined SLICE use table

And if possible, please add facility reference number, which is currently missing from the data in which you identified rows to be removed.

Raju

From: Sandberg, Krista [mailto:Krista.Sandberg@dfo-mpo.gc.ca]
Sent: 2018-07-04 1:29 PM
To: Gautam, Raju (CFIA/ACIA); Waddington, Zac
Subject: RE: refined SLICE use table

Hold tight. I'm just finishing up my additions of pre/post treatment lice abundances, along with refinements to the treatments that can be removed. I should have this to you by lunch.

Krista.

Krista Sandberg
Office | Bureau 250-286-5835
Cellular | Cellulaire [REDACTED]



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From: Gautam, Raju (CFIA/ACIA) [mailto:raju.gautam@canada.ca]
Sent: July-04-18 10:22 AM
To: Sandberg, Krista; Waddington, Zac
Subject: RE: refined SLICE use table

Hi Sheri,

I can make use of this if you think it is complete now. Are the once to be removed in red font? What about the once highlighted in yellow?

Raju

From: Sandberg, Krista [mailto:Krista.Sandberg@dfo-mpo.gc.ca]
Sent: 2018-07-03 3:03 PM
To: Waddington, Zac
Cc: Gautam, Raju (CFIA/ACIA)
Subject: RE: refined SLICE use table

I've had a look at Ian's file and identified a few more that I think need to be removed – Raju, I can redo the file that I sent you earlier if that's easier.

Krista.

Krista Sandberg
Office | Bureau 250-286-5835
Cellular | Cellulaire [REDACTED]



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From: Waddington, Zac
Sent: July-03-18 10:15 AM
To: Sandberg, Krista
Subject: FW: refined SLICE use table

Here's the SLICE use table that Ian generated over the weekend wherein he removed duplicate entries that went over months, and brood sites. I'm guessing that this should line up nicely with your submitted data to Raju?

Zac

s.16(2)(c)

From: Keith, Ian
Sent: June-29-18 9:26 PM
To: Gautam, Raju (CFIA/ACIA) (raju.gautam@canada.ca)
Cc: Waddington, Zac
Subject: FW: refined SLICE use table

Hi Raju,
Attached the worksheet 'NO BROOD NO DUPLICATES' from this spreadsheet.
280 cases 2013-2018. The extra 17 that were in Zac's file were broodsites and duplicates.
You're good to go.
Ian

From: Keith, Ian
Sent: June-29-18 7:39 PM
To: 'raju.gautam@canada.ca'
Cc: Waddington, Zac
Subject: FW: refined SLICE use table

It was filter function so I will compare the datasets and get back to you.
Ian

From: Keith, Ian
Sent: June-29-18 6:45 PM
To: 'Gautam, Raju (CFIA/ACIA)'
Cc: Waddington, Zac
Subject: RE: refined SLICE use table

Hi Raju,
Sorry for not reading emails earlier.
I started with the dataset that was sent by Krista on Monday, Antibiotic and Production Summary_ALL COMPANIES_restored.xls..but it is 867kb and 1731 rows and the dataset that was saved today with the same file name, at 4:05, in the same folder is 870kb and 1555 rows.
I worked only with the worksheet 'DATA' and have only the Emamectin treatment data. I removed observations where the treatment is recorded for successive months, March and April for example, and recorded it as just April because the treatment started in March and finished in April i.e. the same treatment but with quarterly reports, and no specific instructions for which quarterly report to capture the treatment in. (I expected two records for the same treatment.) This accounts for only a few duplicate treatments however.
I also removed ALL BROOD FACILITIES because you were using just Atlantic salmon production facilities.
Otherwise I added treatments for April 2011 to December 2012Q4. I added these to Antibiotic and Production Summary_ALL COMPANIES_restored.xls/DATA which began with January 2013 and ended with March 2018.
I had access to January 2011-March 2011 but you said that you were using data beginning with April 2011 so I didn't include them.
I see how Zac has all months in this 1555 row spreadsheet but there must be some protection – I can't see more than the last farm, Wicklow so can't see if he removed BROOD facilities and the double records for the same treatment.
I hope from this information you can explain the discrepancy but if you are able to send me the spreadsheet Zac sent you, with protection removed so that I can scroll and compare I may be able to assist you tonight.
Ian

From: Gautam, Raju (CFIA/ACIA) [mailto:raju.gautam@canada.ca]
Sent: June-29-18 3:15 PM
To: Keith, Ian

Cc: Waddington, Zac

Subject: RE: refined SLICE use table

Hi Ian,

Sorry, I was working on the existing data and didn't have time to read through your email and attached files. As I see in the attached excel sheet, there are 298 observations (treatment events), I have a question: Are these all the observations? From what I compiled from the two datasets, one consisting of data from 2013-2018 that Zac provided and the other from 2011-2012 that you provided, there are 315 observation (treatment events). If I use the latest file you sent, then we are short of 17 treatment events. Just wanted to clarify, which dataset should I rely on?

Thank you.

Raju

From: Keith, Ian [mailto:Ian.Keith@dfo-mpo.gc.ca]

Sent: 2018-06-28 9:39 PM

To: Gautam, Raju (CFIA/ACIA)

Cc: Waddington, Zac

Subject: refined SLICE use table

Hi Raju,

Please find attached a refined SLICE use table, renamed from what I sent Tuesday night.

You will find in Column 'P,' highlighted in yellow, what I have classified as resistant or treatment failure. Zac and I discussed again yesterday that we don't have a definition for resistant or treatment failure and my solution was to classify them and provide the data supporting the classifying the case.

I have also highlighted in blue, evidence of reduced efficacy: Messmer et al. give 79% efficacy for a farm compared with all zone (excepting 3.5) efficacy, 90% in 2012. In a different presentation there is the ranking of areas where EC50 for Quatsino is 120 ppb in 2011, higher than EC50 for the other zones (except 3.5)

I have also highlighted in green, cases where I suspect some reduced efficacy but no bioassay data or strong evidence of selecting resistant lice.

I have comments too, without highlight, where there is repeated treatment without recruitment of lice from wild fish. These are farms that we think have increased risk of resistance. Along with these comments are farms where there is evidence of internal recruitment i.e. 'INTERNAL AMPLIFICATION.' This is expected and I haven't done an exhaustive job of capturing these in Column 'P', only those for which I have some suspicion of increased risk of resistance selection. So I leave these for you, imagining that you might, using a categorical variable, capture only the yellow highlighted cases. However, the weaker data are there too, the blue and green highlighted and the unhighlighted cases for creating a ordinal variable if the data can tolerate this. My order is yellow, blue, green and unhighlighted.

Good luck

Ian

Dr. Ian Keith DVM

Field Operations Veterinarian – Pacific Region

Fisheries and Oceans Canada | Pêches et Océans Canada

Fisheries Management

Aquaculture Management Division | Gestion de l'aquaculture

Aquaculture Environmental Operations – Fish Health

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Ian.Keith@dfo-mpo.gc.ca

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s.20(1)(b)

s.20(1)(b)

[illegible]

[illegible]

s.20(1)(b)

Jones, Simon

From: Connors, Brendan
Sent: Monday, July 16, 2018 9:25 PM
To: Jones, Simon
Subject: Possible collaboration? experimentally testing popn. level effects of sea lice on pinks
Attachments: SEP_letter_Nanaimo_River_Experimental_Release_Project.pdf;
Experimental_sea_lice_proposal.pdf

Follow Up Flag: Follow up
Flag Status: Completed

Categories: Yellow Category

Hi Simon,

I'm writing to inquire if you have any interest in potentially collaborating on a project (see attached draft proposal) that seeks to experimentally quantify the population level effects of sea louse infection on pink salmon. In a nutshell the idea is to release paired groups of SLICE-treated and placebo-treated juvenile pink salmon that are individually tagged (thermal otolith marks), and assess differences in marine survival between treated and untreated fish by counting how many of each group return to spawn 18ish months later. Despite some obvious limitations, I think such a manipulative experiment, which has never occurred in the Pacific but as you probably know has been done dozens of time in the Atlantic, would allow for strong inference about the population level effects of sea louse infection on wild Pacific salmon.

[redacted] with Jeff Hutchings at Dalhousie) is leading the project and we had some initial discussions with the Nanaimo River Hatchery and the Snuneymuxw First Nation about the project, both of whom are very supportive. We propose the Nanaimo Hatchery because it already rears pinks and uses net pens, plus there is little natural production from system making recovering marked spawners more realistic. In order to proceed the Nanaimo hatchery (which is a community hatchery) would need SEP approval, and though we had some initial positive discussions with SEP, an internal review of the project led to the official decision to not support it at this time (also attached).

[redacted] and I met with SEP last week to better understand their concerns. The take home from the meeting was that it would be much easier for SEP to sign off of the project if the merits of the project were recognized and articulated by others at DFO (i.e., in the Science and Fisheries and Aquaculture Management branches) and if others from Science were also involved. To this end: (1) I had a follow up conversation with Nathan Taylor who thought the proposal had strong merit and offered to follow up with Allison Webb and Andy Thomson about it, and (2) I offered to follow up with other researchers about prospects for collaboration. You are obviously a leader in the department when it comes to research into interactions between parasites and salmon and in addition to critical feedback on the current proposal you may have some interest and ideas about cool side investigations that could be paired with it.

I'll stop here given how long this email already is, and encourage you to drop me a note or give me a call sometime if you have any interesting in discussing this project and the potential to collaborate on it.

Many thanks for your consideration.

s.19(1)

Brendan



Fisheries and Oceans
Canada

Pêches et Océans
Canada

October 16, 2017

[REDACTED]
Department of Biological Sciences
Simon Fraser University
Burnaby, British Columbia
V5A 1S6

[REDACTED]
Thank you for meeting with Fisheries and Oceans Canada, Salmonid Enhancement (DFO SEP) staff on July 13th, 2017 to discuss your experimental design to test the effect of early sea lice protection on the recruitment of pink salmon in southern British Columbia.

During the meeting, the life history of Nanaimo pink salmon, current population health and enhancement release strategies were discussed. Logistical information was provided by [REDACTED] Nanaimo River Hatchery [REDACTED] on operations and infrastructure related to their existing pink enhancement program. You also indicated through your email of October 10, 2017 that both the Snuneymuxw First Nation and the Nanaimo River Hatchery have indicated support for this project to move forward.

As indicated at the time of our meeting, DFO SEP would need to conduct an internal review of this proposal to better understand any concerns that may need to be considered. In this regard, our review indicated that the proposal does not align well with the principles of the Salmonid Enhancement Program, specifically conducting enhancements of salmon species in a manner and fashion that do not require the use of early protection to sea lice. As you are aware, all of DFO SEP enhancement operations are licensed under the Pacific Aquaculture Regulations which details activities that are approved to be undertaken at each facility and in accordance with best management practices. It is based on concerns identified by DFO's veterinarian regarding treatments in net pens open to the marine environment, and the perception that DFO SEP enhancements may require treatment from sea lice to be considered viable, that we cannot provide you formal support for this experiment at this time.

If you have any questions, or wish to discuss this further, please don't hesitate to call David Willis, Erica Blake or myself.

Yours sincerely,

Dale Desrochers

South Coast Area Section Head
Community Involvement and Resource Restoration
Salmonid Enhancement Program
Telephone: 250-756-7122

s.19(1)

Proposal - Experimental Epidemiology of Salmon Migrations

Collaborators

Academia: [REDACTED] Larry Dill, Jeff Hutchings, Martin Krkosek
Nanaimo River Hatchery: [REDACTED]
Snuneymuxw First Nation: [REDACTED]
Raincoast Conservation Foundation: [REDACTED]
DFO: Brendan Connors, David Willis, Mel Sheng ([REDACTED])

Background

The effects of pathogens and parasites on wild salmon are of increasing interest to both management and conservation. Over the past decade, several infectious agents have been linked to Pacific salmon mortality, but the population-level effects of these agents are largely unknown and highly contested. This is because it is difficult to disentangle the effects of disease from other processes (e.g., climate) that lead to variation in salmon survival and returns from year to year. For example, a parasite - sea lice - has been a focus of research and management in British Columbia, and although correlative studies have demonstrated associations between sea lice and wild salmon productivity (e.g., Connors et al. 2010, Krkošek et al. 2011), the magnitude of the effect is debated and causal links remain elusive (Marty et al. 2010, Saksida et al. 2015).

An experimental method to test the population-level effects of pathogens and parasites on wild salmon has been developed and applied in Europe, but this has yet to be pursued in the Pacific. The experiments involve releasing paired groups of drug-treated and placebo-treated juvenile salmon that are individually tagged, and assessing differences in marine survival between treated and untreated fish by counting how many of each group return to spawn (Krkošek et al. 2013, Vollset et al. 2016). Those studies have found that protection against sea lice in Atlantic salmon smolts causes an increase in recruitment that is consistently evident but variable in magnitude among trials, ranging up to 40%.

We propose to perform a similar manipulative experiment in the Salish Sea using hatchery-raised pink salmon and a parasiticide to prevent early marine infection by sea lice. If the initial year of the project were successful, it is also possible we could test the population-level effects of at least one consequential virus or bacterium by adding another treatment group with a different drug treatment.

Primary objective

Experimentally test and estimate the effect of early sea lice protection on the recruitment of pink salmon in southern BC.

Outline

The general methodological approach of the experiment would be: 1) raise pink salmon from eggs in a hatchery; 2) separate the fish into two groups (treatment and control); 3) uniquely mark the otoliths of each group; 4) feed one group with anti-lice treated feed (SLICE®) and the other group with sham-treated feed; 5) release the juvenile salmon after one week of treatment; 6) collect otoliths from dead salmon when they return to spawn; and 7) compare the number, size, growth rate, run timing, and overall health of returning salmon from the treatment and control groups.

By far the best BC hatchery for this experiment is the Nanaimo River Hatchery (Figure 1), which releases one million juvenile pink salmon every year. The Nanaimo River Hatchery is uniquely suited for this experiment because it already thermally marks pink salmon otoliths (details below), it feeds juvenile

pink salmon before releasing them (which is rare), and the Nanaimo River has relatively few 'natural' (non-hatchery) spawners to interfere with the study. We would be using pink salmon because it has the shortest and most consistent life cycle of any Pacific salmon – two years from egg to death.

Prior to the start of the experiment, we would confirm that the primary early marine migration route for juvenile Nanaimo River pink salmon is northwards between Vancouver Island and mainland BC (where high levels of sea lice are known to occur) rather than southwards (where sea lice levels are unknown). Hatchery staff and SEP personnel expect the northward migration path to be the primary one, as it is for salmon from nearby rivers. We would confirm this using beach seine nets from power boats to capture pink salmon fry north and south of the Nanaimo River, gradually moving further away from the release point over three weeks (Figure 2). We would collect otoliths from a subset of the fish in each collection, and these otoliths would be processed by the otolith laboratory at the Washington Department of Fisheries and Wildlife (WDFW) to determine whether Nanaimo River salmon were mostly caught north of the river, as expected. Genetic stock identification is not an option for determining the origin of the fish because the Nanaimo River hatchery salmon are often offspring of spawners from other rivers.

This study would work closely with the existing hatchery operations at Gallows Point by adding another pen and dividing the [REDACTED] fish that are typically raised there into two groups of [REDACTED] – one treatment and one control. These two groups would have each been given their own unique thermal otolith mark during freshwater rearing. Both groups would be fed as normal for their first three weeks in the net pens. In the fourth and final week before release, the treatment group would have its normal food coated in emamectin benzoate (trade name SLICE®) to provide protection against sea lice for two months (Lees et al. 2008, Saksida et al. 2010). Emamectin benzoate is the BC aquaculture industry's standard treatment to protect against sea lice (Saksida et al. 2010). It does not cause appetite suppression in Atlantic salmon (Ramstad et al. 2002), accumulate in individuals or up the food chain (Chukwudebe et al. 1996, Chukwudebe et al. 1998), or trigger any restrictions on the release of fish in BC. We will have already performed initial trials to confirm that juvenile pink salmon are similarly unaffected.

s.20(1)(b)

The released pink salmon would return to spawn in the fall 18 months later, and we would conduct field work to collect the otoliths from 3000 dead spawners (see appendix for power analysis). These otoliths would be processed at the WDFW to determine the number of fish that returned from our treatment and control groups. The small size of pink salmon fry (unscaled juveniles) and/or large number of salmon needed precludes several tagging options (e.g., coded wire tags and passive integrated transponders), and the need for two unique 'marks' without any confounding tagging effects precludes others (e.g., fin clips and parentage-based tagging). The study would run for three years of pink salmon releases to ensure there is a high likelihood (i.e., greater than a 9 in 10 chance) of detecting a true decrease in survival due to sea lice as great or greater than 10%, should one have in fact occurred.

Potential benefits and risks

This study would be the first of its kind in BC and the Pacific overall, and its results would address an important and unresolved question for salmon conservation and management – the extent to which early marine exposure to sea lice reduces salmon recruitment. There would also be at least two short-term employment opportunities each year that would be offered to members of the Snuneymuxw First Nation.

As discussed above, there is minimal ecological risk associated with treating the salmon fry with SLICE according to industry standards, especially at the amounts we are proposing (30g treatments, which

corresponds to 0.01% of the amount that would be used in a single treatment on a single large salmon farm with harvest-size fish). However, some initial trials would need to be performed prior to the full treatment to ensure that juvenile pink salmon are similarly unaffected, and that the SLICE coating does not cause any physical changes to the pinks' feed (which is finer than what is fed to Atlantic salmon). The administration of SLICE does not require any safety equipment other than gloves.

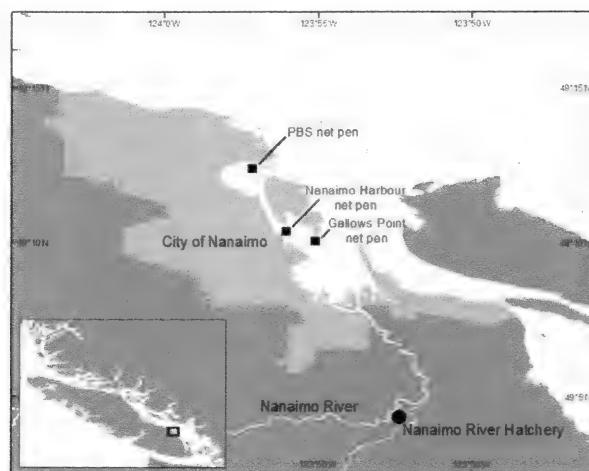


Figure 1. Map of the proposed study area.

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DRAFT

Waddington, Zac

From: Gautam, Raju (CFIA/ACIA) <raju.gautam@canada.ca>
Sent: July-16-18 12:30 PM
To: Waddington, Zac
Subject: RE: Preliminary Findings

Hi Zac,

Hope you are back to work. I am just following up on my earlier email to check if you had a chance to review the figures. It would be good to organise a webex meeting to discuss final steps. I think the data reflects some evidence about your assumption of the number of treatments and resistance, but depends on the level of confidence you are comfortable with given the number of observations. We can discuss all this and finalize the analysis plan during our meeting. Please let me know when will be a good time for you and whether you will organize the meeting or I should do it.

Thank you.
Raju

From: Gautam, Raju (CFIA/ACIA)
Sent: 2018-07-12 10:36 AM
To: 'Waddington, Zac'; 'Manchester, Howie'; 'Sandberg, Krista'; 'Keith, Ian'
Subject: RE: Preliminary Findings

Just to provide a context for you when you are assessing Figure 4. In the attached pdf, you will find resistance profile of FHZ vs average number of slice treatments per production cycle.

Happy Thursday.
Cheers,
Raju

From: Gautam, Raju (CFIA/ACIA)
Sent: 2018-07-11 5:16 PM
To: Waddington, Zac; Manchester, Howie; 'Sandberg, Krista'; Keith, Ian
Subject: Preliminary Findings

Hi All,

I have integrated the data, except for environmental data and have few figures to share with you, please see attached PDF. Please note from Figure 1 that wild fish return is not available for most FHZs in 2017. Need to discuss how to handle that (replace with 0s or any other option). Also, please check the last figure that describes the average number of slice treatment by FHZ (is it something you would expect or not). We may need to set up webex meeting to explain the analysis steps and discuss next steps before I develop the final model to address the question we wanted to answer.



Cheers,
Raju

s.19(1)

Waddington, Zac

From: Keith, Ian
Sent: July-18-18 10:48 AM
To: Waddington, Zac
Subject: RE: Preliminary Findings

This would actually be a good test for his model because the change in SLICE use in 3.5 is restricted to once per cycle, with single year class in Findlayson Channel. The exception was in Winter/Spring 2017 with having to move the fish from Cougar to Kid or Goat [REDACTED]

I have a fair bit of confidence in this but Diane could confirm.

Ian

From: Waddington, Zac
Sent: July-18-18 9:26 AM
To: 'Gautam, Raju (CFIA/ACIA)'; Manchester, Howie; Sandberg, Krista; Keith, Ian
Subject: RE: Preliminary Findings

That is very interesting! Thanks very much for your work to make that happen. I would be very curious to see SLICE treatments by zone, broken down by year? Especially in 3.5 where resistance was first identified, I think that could be very interesting to see how and if their SLICE use has changed. In figure 1, are those values on the y axis number of wild fish as a proportion of farmed fish in the FHZs? Or are they absolute numbers?

Zac

From: Gautam, Raju (CFIA/ACIA) [mailto:raju.gautam@canada.ca]
Sent: July-11-18 2:16 PM
To: Waddington, Zac; Manchester, Howie; Sandberg, Krista; Keith, Ian
Subject: Preliminary Findings

Hi All,

I have integrated the data, except for environmental data and have few figures to share with you, please see attached PDF. Please note from Figure 1 that wild fish return is not available for most FHZs in 2017. Need to discuss how to handle that (replace with 0s or any other option). Also, please check the last figure that describes the average number of slice treatment by FHZ (is it something you would expect or not). We may need to set up webex meeting to explain the analysis steps and discuss next steps before I develop the final model to address the question we wanted to answer.

[REDACTED]
Cheers,
Raju

s.19(1)
s.20(1)(b)

Manchester, Howie

From: Gautam, Raju (CFIA/ACIA) <raju.gautam@canada.ca>
Sent: July-18-18 11:44 AM
To: Waddington, Zac; Manchester, Howie; Sandberg, Krista; Keith, Ian
Subject: RE: Preliminary Findings
Attachments: NtrtByZoneYearFigureJuly18_2018.pdf

Hi Zac,

Here is the figure you wanted, see attached. I have included the number of active sites by Zone and Year below to give you a platform for comparison.

Raju

From: Waddington, Zac [<mailto:Zac.Waddington@dfo-mpo.gc.ca>]
Sent: 2018-07-18 12:26 PM
To: Gautam, Raju (CFIA/ACIA); Manchester, Howie; Sandberg, Krista; Keith, Ian
Subject: RE: Preliminary Findings


That is very interesting! Thanks very much for your work to make that happen. I would be very curious to see SLICE treatments by zone, broken down by year? Especially in 3.5 where resistance was first identified, I think that could be very interesting to see how and if their SLICE use has changed. In figure 1, are those values on the y axis number of wild fish as a proportion of farmed fish in the FHZs? Or are they absolute numbers?

Zac

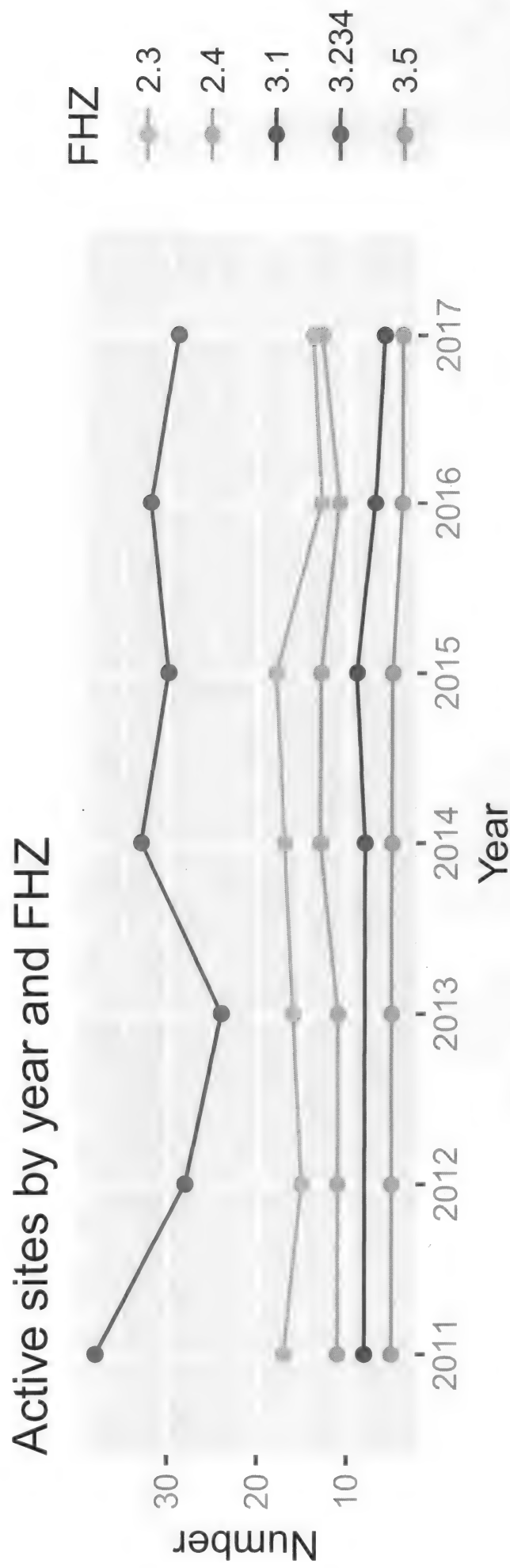
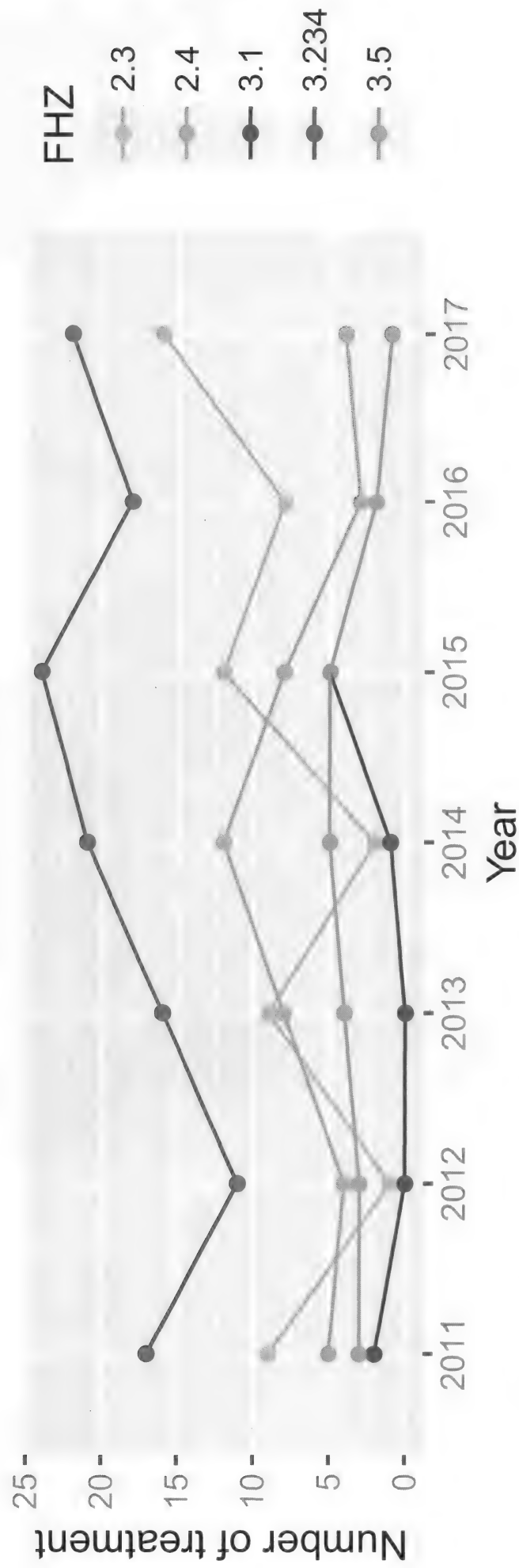
From: Gautam, Raju (CFIA/ACIA) [<mailto:raju.gautam@canada.ca>]
Sent: July-11-18 2:16 PM
To: Waddington, Zac; Manchester, Howie; Sandberg, Krista; Keith, Ian
Subject: Preliminary Findings

Hi All,

I have integrated the data, except for environmental data and have few figures to share with you, please see attached PDF. Please note from Figure 1 that wild fish return is not available for most FHZs in 2017. Need to discuss how to handle that (replace with 0s or any other option). Also, please check the last figure that describes the average number of slice treatment by FHZ (is it something you would expect or not). We may need to set up webex meeting to explain the analysis steps and discuss next steps before I develop the final model to address the question we wanted to answer.


Cheers,
Raju

s.19(1)



Manchester, Howie

From: Manchester, Howie
Sent: June-28-18 11:04 AM
To: Stenhouse, Shawn
Cc: Waddington, Zac
Subject: FW: Data points in Slice use dataset that are missing in sealice abundance dataset
Attachments: DataPoints_inSliceDatasetNot_in_abundanceCount.csv

As discussed with Zac.

Howie

From: Waddington, Zac
Sent: June-28-18 10:57 AM
To: Manchester, Howie
Subject: FW: Data points in Slice use dataset that are missing in sealice abundance dataset

From: Gautam, Raju (CFIA/ACIA) [<mailto:raju.gautam@canada.ca>]
Sent: June-28-18 9:57 AM
To: Waddington, Zac; Keith, Ian
Subject: Data points in Slice use dataset that are missing in sealice abundance dataset

Hi Zac,

There are 10 observations that are missing from abundance dataset that are present in slice use dataset, please see attached.

Raju Gautam

Epidemiologist, Aquatic Surveillance and Epidemiology Section
Canadian Food Inspection Agency / Government of Canada
raju.gautam@canada.ca / Tel: 613-773-6764

épidémiologiste, Section aquatique de surveillance et d'épidémiologie
Agence canadienne d'inspection des aliments / Gouvernement du Canada
raju.gautam@canada.ca / Tel: 613-773-6764

site.REF	Month	year	date	month.x	biomass	rowseq	date.diff	cohort
1580	Oct	2014	NA	NA	NA	NA	NA	NA
1702	MAY	2012	NA	NA	NA	NA	NA	NA
1702	OCT	2011	NA	NA	NA	NA	NA	NA
1702	OCT	2012	NA	NA	NA	NA	NA	NA
1895	APR	2016	NA	NA	NA	NA	NA	NA
211	AUG	2011	NA	NA	NA	NA	NA	NA
211	MAR	2011	NA	NA	NA	NA	NA	NA
380	Jun	2014	NA	NA	NA	NA	NA	NA
520	JUL	2015	NA	NA	NA	NA	NA	NA
543	JUL	2015	NA	NA	NA	NA	NA	NA

month.y	licence.hol	site.name	lat	long	FHZ	N.countPer	N.motile	N.females
NA	NA	NA	NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA	NA	NA	NA

N.chalimus	N.caligus	comments	Year.class	Company	FacilityName	LandfileNo	FishHealth	Species
NA	NA	NA	NA	Marine Har	Jackson Pa:	6406814	05-Mar	Atlantic Sal
NA	NA	NA	NA	Marine Har	Goat Cove,	6407324	03-May	Atlantic Sal
NA	NA	NA	NA	Marine Har	Goat Cove,	6407324	03-May	Atlantic Sal
NA	NA	NA	NA	Marine Har	Goat Cove,	6407324	03-May	Atlantic Sal
NA	NA	NA	NA	Marine Har	Sheep Pass	6407839	05-Mar	Atlantic Sal
NA	NA	NA	NA	Marine Har	Sonora Isla	1403325	03-Feb	Atlantic Sal
NA	NA	NA	NA	Marine Har	Sonora Isla	1403325	03-Feb	Atlantic Sal
NA	NA	NA	NA	Marine Har	Sonora Pt.,	1403144	02-Mar	Atlantic Sal
NA	NA	NA	NA	Cermaq Ca	Bedwell, E:	1403980	03-Feb	Atlantic Sal
NA	NA	NA	NA	Cermaq Ca	Mussel Roc	1401589	03-Feb	Atlantic Sal

BroodProd	Therapeut	WeightActi	FishHealth	(Occurrence)	Mitigative	Dosage	uni.id
Production Enamectin		0.028174					1580Oct2014
Production Enamectin							1702MAY2012
Production Enamectin							1702OCT2011
Production Enamectin							1702OCT2012
Production Hydrogen F		5880					1895APR2016
Production Enamectin							211AUG2011
Production Enamectin							211MAR2011
Production Enamectin		0.875187					380Jun2014
Production Enamectin		0.295					520JUL2015
Production Enamectin		0.313					543JUL2015

Waddington, Zac

From: Keith, Ian
Sent: July-19-18 11:17 AM
To: Waddington, Zac
Subject: relevant SLICE with peroxide paper
Attachments: Lees efficacy Scotland.pdf

Hey,
This is likely where your 40% reduction came from.
They looked for factors.

Ian Keith
A/Fish Health Veterinarian
Fisheries and Oceans | Salmonid Enhancement Program
3190 Hammond Bay Road, Nanaimo, BC V9T 6N7
Mobile: [REDACTED] | Fax: 250-729-8377

s.16(2)(c)

The Efficacy of Emamectin Benzoate against Infestations of *Lepeophtheirus salmonis* on Farmed Atlantic Salmon (*Salmo salar* L) in Scotland, 2002–2006

Fiona Lees^{1,2}, Mark Baillie², George Gettinby¹, Crawford W. Revie^{2*}

1 Department of Statistics and Modelling Science, University of Strathclyde, Glasgow, United Kingdom, **2** Department of Computer and Information Sciences, University of Strathclyde, Glasgow, United Kingdom

Abstract

Background: Infestations of the parasitic copepod *Lepeophtheirus salmonis*, commonly referred to as sea lice, represent a major challenge to commercial salmon aquaculture. Dependence on a limited number of therapeutics to control such infestations has led to concerns of reduced sensitivity in some sea lice populations. This study investigates trends in the efficacy of the in-feed treatment emamectin benzoate in Scotland, the active ingredient most widely used across all salmon producing regions.

Methodology/Principal Findings: Study data were drawn from over 50 commercial Atlantic salmon farms on the west coast of Scotland between 2002 and 2006. An epi-informatics approach was adopted whereby available farm records, descriptive epidemiological summaries and statistical linear modelling methods were used to identify factors that significantly affect sea lice abundance following treatment with emamectin benzoate (SLICE[®], Schering Plough Animal Health). The results show that although sea lice infestations are reduced following the application of emamectin benzoate, not all treatments are effective. Specifically there is evidence of variation across geographical regions and a reduction in efficacy over time.

Conclusions/Significance: Reduced sensitivity and potential resistance to currently available medicines are constant threats to maintaining control of sea lice populations on Atlantic salmon farms. There is a need for on-going monitoring of emamectin benzoate treatment efficacy together with reasons for any apparent reduction in performance. In addition, strategic rotation of medicines should be encouraged and empirical evidence for the benefit of such strategies more fully evaluated.

Citation: Lees F, Baillie M, Gettinby G, Revie CW (2008) The Efficacy of Emamectin Benzoate against Infestations of *Lepeophtheirus salmonis* on Farmed Atlantic Salmon (*Salmo salar* L) in Scotland, 2002–2006. PLoS ONE 3(2): e1549. doi:10.1371/journal.pone.0001549

Editor: Ross Thompson, Monash University, Australia

Received: October 5, 2007; **Accepted:** January 14, 2008; **Published:** February 6, 2008

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Funding: The database underpinning this work was created as part of two UK government funded research projects (MAFF LINK-ENV12; DEFRA-VM0213). The funders had no role in study design, data collection and analysis, decision to publish, or preparation of the manuscript.

Competing Interests: The authors have declared that no competing interests exist.

*E-mail: crawford.revie@cis.strath.ac.uk

Introduction

Commercial farming of Atlantic salmon (*Salmo salar* L) has developed rapidly since the 1970's, with global production exceeding one million tonnes per annum since 2002 [1]. Atlantic salmon farming is currently dominated by the aquaculture industries of Norway and Chile, however Scotland and Canada are also major producers.

As intensive marine aquaculture developed, the threat posed to fish health and production by infestations of parasitic copepods emerged as one of the greatest challenges facing the industry [2]. Not only can these aquatic parasites inhibit growth and cause extensive damage, extreme infestation can lead to host mortality [3]. It has also been suggested that caligid copepods, commonly referred to as sea lice, originating from salmon farms may pose a risk to wild salmonid populations [4–8].

In Scotland two species of sea lice parasitise farmed salmonids: *Lepeophtheirus salmonis* (Kroyer 1837) and *Caligus elongatus* (Nordmann 1832). Of the two species, *L. salmonis* is the larger and more abundant [9]. Whereas *C. elongatus* is known to parasitise more

than 80 species of fish, the major species of interest *L. salmonis* is principally confined to salmonids [10].

In response to the challenges presented by sea lice infestation, salmon producers on the west coast of Scotland have developed integrated health management programmes based on previous research into the epidemiology of sea lice [11–14] and farm management practices [15–18]. Some of these management strategies have proven to be successful and, together with the availability of more effective ectoparasitic medicines, have helped to reduce the abundance of *L. salmonis* and *C. elongatus* on Scottish farms over the past decade [19]. Nevertheless, sea lice remain a persistent problem and the cost of controlling these parasites is substantial [18].

The availability and use of medicines to control sea lice burdens in Scotland has changed considerably in the last decade and since 2005 only two therapeutics have been in common use; the topical treatment cypermethrin (Excis[®], Novartis Animal Health) and the in-feed treatment emamectin benzoate (SLICE[®], Schering Plough Animal Health). Both ectoparasiticides are widely used and, since obtaining UK Market Authorisation in 2000, the use of

**Pages 827 to / à 836
are withheld pursuant to section
sont retenues en vertu de l'article**

68(a)

**of the Access to Information Act
de la Loi sur l'accès à l'information**

Higgins, Mark

From: Higgins, Mark
Sent: July-25-18 9:46 AM
To: 'kim.klotins@inspection.gc.ca'
Subject: FW: Sea lice herring
Attachments: 35671672_10156295375275479_2032930676872839168_o.jpg

This was the first email about the die off that came to DFO. Mark.

From: Jones, Simon
Sent: June-21-18 9:19 AM
To: Higgins, Mark
Cc: Lowe, Carmel; Kennedy, Eddy; Taylor, Nathan
Subject: FW: Sea lice herring

Mark,

This just in. Herring die-offs are not unusual at this time of the year and often are associated with VHS virus. Herring commonly have sea lice infestations (usually Caligus) and although these are highly visible, they are not usually considered responsible for die-offs. I've left a message with Brenda McCorquodale requesting specimens (e.g., the ones in the photo) for laboratory examination. I've also spoken to Doug and Eric in the MRP program who may have staff out there who could get some samples. Also spoke to the vet at Grieg who have farms in the area. Workers will be asked to be aware of herring mortalities and collect samples. My crew is returning from Port Macneil this afternoon so not available to do Tofino/Hot Springs today.
Will keep you posted.

Simon

From: Lowe, Carmel
Sent: June-21-18 8:35 AM
To: Kennedy, Eddy; Jones, Simon
Cc: Taylor, Nathan
Subject: Fw: Sea lice herring

Do we have anything on this?

Carmel

Sent from my BlackBerry 10 smartphone on the Rogers network.

From: Thomson, Andrew <Andrew.Thomson@dfo-mpo.gc.ca>
Sent: Thursday, June 21, 2018 08:33
To: Reid, Rebecca
Cc: Lowe, Carmel; LaRue, Jean-François
Subject: FW: Sea lice herring

FYI as there may be questions on this.

Andrew J L Thomson

Regional Director | Directeur Régionale
Fisheries Management Branch | Direction de la gestion des pêches

From: Webb, Allison
Sent: Thursday, June 21, 2018 8:26 AM
To: Rainer, Michelle <Michelle.Rainer@dfo-mpo.gc.ca>; Thomson, Andrew <Andrew.Thomson@dfo-mpo.gc.ca>
Cc: Girouard, Louise <Louise.Girouard@dfo-mpo.gc.ca>
Subject: FW: Sea lice herring

FYI

From: McCorquodale, Brenda
Sent: Thursday, June 21, 2018 8:01 AM
To: Paylor, Adrienne <Adrienne.Paylor@dfo-mpo.gc.ca>; Webb, Allison <Allison.Webb@dfo-mpo.gc.ca>
Subject: Sea lice herring

This is going viral on Facebook - in case you have not seen.

"Thousands of herring covered in sea lice washing up in Hot Springs cove"

Brenda McCorquodale

Regional Manager, Aquaculture Resource Management
Fisheries and Oceans Canada
Gestionnaire régionale des ressources, Direction des pêches
Pêches et Océans Canada

1965 Island Diesel Way | Nanaimo, BC | Nanaimo, CB | V9S 5W8
Email | Courriel: Brenda.McCorquodale@dfo-mpo.gc.ca
Telephone | Téléphone: 250-902-8865



Waddington, Zac

From: Sandberg, Krista
Sent: July-25-18 2:38 PM
To: Waddington, Zac
Subject: RE: Follow up

I'm planning on getting Sean to compile the data on templates and upload 2011/2012 into AQUIS ☺ Working on more recent data first though.

Krista Sandberg

Office | Bureau 250-286-5835

Cellular | Cellulaire [REDACTED]



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From: Waddington, Zac
Sent: July-25-18 2:11 PM
To: Sandberg, Krista; Gautam, Raju (CFIA/ACIA); Keith, Ian
Cc: Bruneau, Nathalie (CFIA/ACIA)
Subject: RE: Follow up

Thanks a bunch Krista. I think that if the PFMA data is aggregated over both 3.3 and 3.4 FHZ's then that should be fine to leave that lumping in our own inventory data given that we assume they will both clearly be "high spillover" areas in our model. At some point it would be excellent to get the 2011 and 2012 data, but I fully recognize how busy you are and I'll leave it up to you to tackle that when you have time. Raju, is there any time pressure on your end regarding getting this data? Or are you able to pause your work pending this data?

Zac

From: Sandberg, Krista
Sent: July-25-18 1:46 PM
To: Waddington, Zac; Gautam, Raju (CFIA/ACIA); Keith, Ian
Cc: Bruneau, Nathalie (CFIA/ACIA)
Subject: RE: Follow up

-We have inventory data for 2011 and 2012 but it has not been summarized as it was not managed by me back then. It would take some effort to pull the data from individual reports, and I don't have the time to do this right now.

3.3 and 3.4 were combined because current breakdown is by PFMA area, not fish health zone and Area 12 includes both 3.3 and 3.4. Again, these could be broken down but would take a bit of effort – not much extra for this one, but I just can't get to it right now...

Krista.

Krista Sandberg

Office | Bureau 250-286-5835

Cellular | Cellulaire [REDACTED]



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s.16(2)(c)

Canada

From: Waddington, Zac
Sent: July-25-18 1:18 PM
To: Sandberg, Krista; Gautam, Raju (CFIA/ACIA); Keith, Ian
Cc: Bruneau, Nathalie (CFIA/ACIA)
Subject: RE: Follow up

Thanks so much Krista! Do we have inventory data for 2011 and 2012 by any chance? And I'm wondering if we could break out 3.3 and 3.4. Or did you combine them because the wild escapement data is lumped as well?

Zac

From: Sandberg, Krista
Sent: July-25-18 12:15 PM
To: Waddington, Zac; Gautam, Raju (CFIA/ACIA); Keith, Ian
Cc: Bruneau, Nathalie (CFIA/ACIA)
Subject: RE: Follow up

2013-2017 Inventory attached

Krista Sandberg
Office | Bureau 250-286-5835
Cellular | Cellulaire [REDACTED]



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From: Waddington, Zac
Sent: July-25-18 11:16 AM
To: Gautam, Raju (CFIA/ACIA); Sandberg, Krista; Keith, Ian
Cc: Bruneau, Nathalie (CFIA/ACIA)
Subject: RE: Follow up

Thanks again for all your help Raju. Krista is putting together an average inventory for all farms in a given zone from June-end of Dec. for each year. So you will have only one number to compare to the wild escapement data. I am still trying to get a hold of the environmental data, but if that can't be done before you exhaust your allocated time then so be it.

Zac

From: Gautam, Raju (CFIA/ACIA) [mailto:raju.gautam@canada.ca]
Sent: July-25-18 11:10 AM
To: Waddington, Zac; Sandberg, Krista; Keith, Ian
Cc: Bruneau, Nathalie (CFIA/ACIA)
Subject: RE: Follow up

Hi Zac,

Thank you for sending this. And I assume you are going to send the inventory data that has the actual number of fish in the farm? I will work on this request once I have complete data including the inventory data that is yet to come. I have discussed work related to this request with my Manager, Nathalie Bruneau (copied in this email) and she has kindly approved me to dedicate the time required to complete this (± 2 days). In the event there is a need for further analysis, I will be happy to pass on the final data and provide explanation for all that was done to the person that takes it on and continue to engage on this project to provide input and consultation.

Thank you.

Raju

From: Waddington, Zac [mailto:Zac.Waddington@dfo-mpo.gc.ca]

Sent: 2018-07-24 2:45 PM

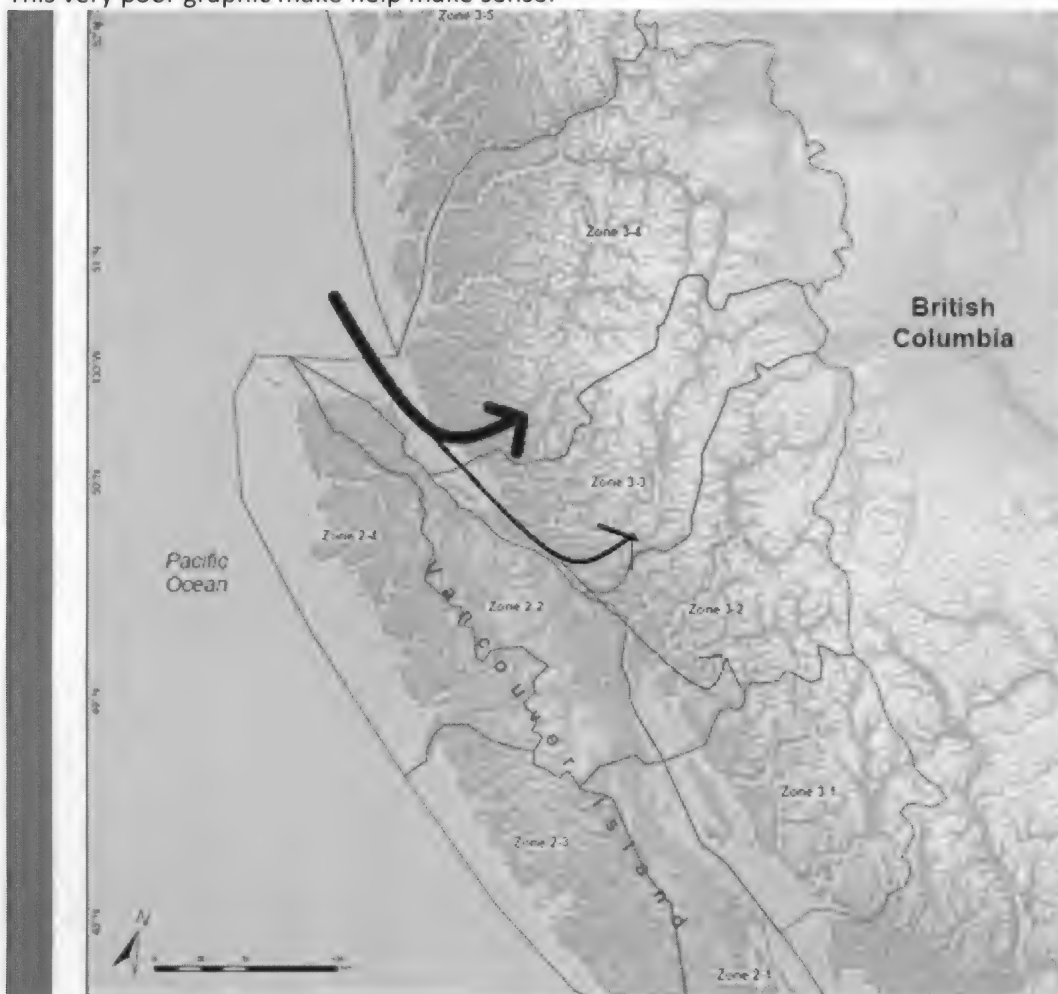
To: Gautam, Raju (CFIA/ACIA); Sandberg, Krista; Keith, Ian

Subject: Follow up

Sorry for the delay, we had a major IT crash which knocked our email down for Friday and much of the weekend, and then I was out of the office yesterday. But to follow up on what I said I was going to do:

1. Rule for how to allocate wild fish returns to Fish Health Zones 3.4, 3.3 and 3.2:
 - a. The assumption being made is that all fish returning to zones 3.4, 3.3 and 3.2 do so from the north through the Queen Charlotte Strait. Therefore, all fish that return to FHZ 3.2 will be assumed to have a spillover effect on all zones they pass through during their migration back to their natal streams.
 - i. Therefore, the wild fish return numbers for FHZ 3.2 will solely be those that return to streams within FHZ 3.2
 - ii. The wild fish return numbers for FHZ 3.3 will include all wild fish that return to streams within FHZ 3.2 or 3.3
 - iii. The wild fish return numbers for FHZ 3.4 will include all wild fish that return to streams within FHZ 3.4, 3.3 or 3.2

This very poor graphic make help make sense:



2. I think the best rule to try and measure the risk of SLICE resistance as a function of multiple treatments on one cohort of fish at a farm would be to first break each farm(s) into pre- and post- SLICE resistance eras. Given that treatment with SLICE would/should have changed drastically after the development of resistance, I think it's vital that we make that division in the data. I am still waiting to hear back from Marine Harvest on the quarter in which they first identified resistance in Klemtu and Quatsino. But I think that if we simply identify the quarter in

which resistance emerged in farm or zone, then we can treat all quarters previous as “pre-SLICE resistance era” and all quarters following as “post-SLICE resistance era.”

To arrive at the best measure of repeated SLICE use, on a given fish, at a given farm, over time; I suggest we use the formula:

$$\frac{\text{\# of treatments-given cohort}}{\text{\# of cohorts at farm site in either pre-or post-resistance era}} = X$$

The other potential variation would be to try and factor in how many cohorts we present at the farm relative to months of activity. Since some sites may have had cohorts of fish present for less than a full production cycle (i.e. smolt entry sites). In that case the formula could look something like:

$$\text{\# of treatments} \div \text{given cohort} / \frac{\text{\# of cohorts at farm site in either pre-or post-resistance era}}{\text{months active in either pre-or post-resistance era}} = X$$

Totally open to suggestions.

Zac

Dr. Zac Waddington DVM, B.Env.Sc.(Hons)

Lead Veterinarian - Pacific Region

Fisheries and Oceans Canada | Pêches et Océans Canada

Aquaculture Environmental Operations - Fish Health


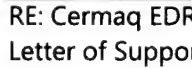
Courtenay, British Columbia

Telephone | Téléphone: 250-703-0902

Fax | Télécopieur: 250-703-0921



Zac.Waddington@dfo-mpo.gc.ca

Waddington, Zac

From: Waddington, Zac
Sent: July-25-18 3:11 PM
To: 
Cc: 
Subject: RE: Cermaq EDR - Lufenuron (Imvixa)
Attachments: Letter of Support for Imvixa EDR, 2018.pdf


Please take a look at this attached letter and see if it suits. Unfortunately I'm not in the office today with access to a printer, so I wasn't able to add a signature.


Zac

From: 
Sent: July-24-18 12:35 PM
To: Waddington, Zac
Cc: 
Subject: Cermaq EDR - Lufenuron (Imvixa)

Hi Zac,



Just following up on our phone conversation.

It would be good to echo  letter to Health Canada, attached here. Essentially it should state reasons why another tool such as Lufenuron is needed in the area although the use of hydrogen peroxide has been approved; as part of effective integrated pest management in the area, the limitations of hydrogen peroxide (no residual protection), lack of infrastructure immediately available to Cermaq in the area when Slice is not effective, possible treatment delays due to environmental conditions in the area and the occasionally complicated logistics of renting well boats from other companies that may also be treating at the same time.

Please let me know if you have any other questions.
Thank you,




CERMAQ

Phone +1 250-286-0022
Direct +1 250-286-0022 ext. 
Mobile 

Cermaq Canada Ltd.
203 - 919 Island Hwy
V9W 2C2 Campbell River, BC, Canada

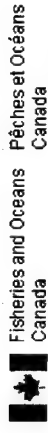
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Aquaculture Management
Fish Health Unit
103 - 2435 Mansfield Drive
Courtenay BC V9N 2M2

Pêches et Océans
Canada
Gestion de l'aquaculture
Santé de poisson
103 - 2435 Mansfield Drive
Courtenay BC V9N 2M2

July 25th, 2018

To Whom It May Concern,

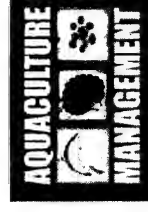
I am writing this letter to voice support for the application by Cermaq for an Emergency Drug Release of the Imvixa in-feed product to be used at two of their hatcheries.

The rotational use of various pest management drugs and techniques is a hallmark of Integrated Pest Management (IPM), and this approach has historically been hindered in BC due to the lack of available licenced therapeutants. The application by Cermaq for Imvixa is in response to documented SLICE resistance at numerous sea sites in the Clayoquot area. They have other treatment modalities current in development (e.g. hydrolizer) and have agreements with other salmon farming companies to use the well-boats necessary for conducting peroxide baths in the area; however these tools may not be available in the period following the planned re-stocking of the sites in Clayoquot in the fall of 2018. As such, it is vitally important that Cermaq has a method of control for sea lice which is readily available at the time of stocking, and not contingent on factors beyond Cermaq's control.

I understand that this product has been used widely and with good effect in other jurisdictions worldwide, without demonstrated negative fish or environmental effects. Provided that Cermaq can demonstrate that their use, and disposal of fish and effluent containing the active ingredient in Imvixa (Lufenuron), meets the requirements set out by Health Canada and the drug manufacturer, I am fully supportive of the use of this product as stated by Cermaq in their EDR application. Furthermore, I would be supportive of the integration of this treatment (and others) into a more routine rotational IPM strategy, implemented across companies along the coast of BC to combat sea lice resistance to any given treatment. Due to the large reservoir of "wild type" lice on wild Pacific salmon on BC's coast, we are in a globally unique position to be able to preserve the long-term efficacy of our paraciticide therapeutants, provided we use them judiciously.

Sincerely,

Dr. Zac Waddington DVM, B.Env.Sc.(Hons)
Lead Veterinarian - Pacific Region
Fisheries and Oceans Canada | Pêches et Océans Canada
Courtenay, British Columbia
Telephone | Telephone: 250-703-0902
Zac.Waddington@dfo-mpo.gc.ca



Ensuring Sustainable Fisheries

Manchester, Howie

From: Manchester, Howie
Sent: July-27-18 10:48 AM
To: Waddington, Zac
Subject: RE: Cermaq EDR - Lufenuron (Imvixa)

Hey Zac,

Was there supposed to be an attachment?

Howie

From: Waddington, Zac
Sent: July-27-18 10:39 AM
To: Manchester, Howie
Subject: FW: Cermaq EDR - Lufenuron (Imvixa)

Please add this to the ITC file for this transfer.

Zac

From: [REDACTED]
Sent: July-27-18 9:03 AM
To: Waddington, Zac
Subject: RE: Cermaq EDR - Lufenuron (Imvixa)

Hi Zac,

Thanks for this, much appreciated!



CERMAQ

Phone +1 250-286-0022
Direct +1 250-286-0022 ext [REDACTED]
Mobile +1 [REDACTED]

Cermaq Canada Ltd.
203 - 919 Island Hwy
V9W 2C2 Campbell River, BC, Canada

Cermaq.ca [Facebook](#) [Twitter](#)

s.19(1)

From: "Waddington, Zac" <Zac.Waddington@dfo-mpo.gc.ca>
To: [REDACTED]
Cc: [REDACTED]
Date: 25/07/2018 03:10 PM
Subject: RE: Cermaq EDR - Lufenuron (Imvixa)

Please take a look at this attached letter and see if it suits. Unfortunately I'm not in the office today with access to a printer, so I wasn't able to add a signature.

Zac

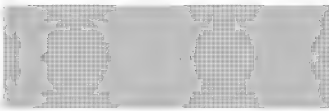
From: [REDACTED]
Sent: July-24-18 12:35 PM
To: Waddington, Zac
Cc: [REDACTED]
Subject: Cermaq EDR - Lufenuron (Imvixa)

Hi Zac,

Just following up on our phone conversation.

It would be good to echo [REDACTED] letter to Health Canada, attached here. Essentially it should state reasons why another tool such as Lufenuron is needed in the area although the use of hydrogen peroxide has been approved; as part of effective integrated pest management in the area, the limitations of hydrogen peroxide (no residual protection), lack of infrastructure immediately available to Cermaq in the area when Slice is not effective, possible treatment delays due to environmental conditions in the area and the occasionally complicated logistics of renting well boats from other companies that may also be treating at the same time.

Please let me know if you have any other questions.
Thank you,
[REDACTED]



CERMAQ

Phone +1 250-286-0022
Direct +1 250-286-0022 ext. [REDACTED]
Mobile [REDACTED]

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-----[attachment "Letter of Support for Invixa EDR, 2018.pdf" deleted by
[REDACTED] Ca/Mainstream/Cermaq]

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Waddington, Zac

From: Waddington, Zac
Sent: July-27-18 1:49 PM
To: 'Emergency Drug Release / Distribution de médicament d'urgence (HC/SC)'
Subject: RE: Emergency Drug Release applications for Imvixa (10% lufenuron) use in BC
Attachments: Letter of Support for Imvixa EDR, 2018.pdf

I apologize for not getting back to you sooner. I have since written a formal letter of support and forwarded that to Cermaq for them to add to their application package. In short, I am fully in support of this application provided they can demonstrate the appropriate controls are in place in their hatcheries to ensure no detrimental impact to the environment occur as a result of exposure to the drug. Please see the attached letter which outlines my views. Feel free to contact me with any further questions?

Dr. Zac Waddington DVM, B.Env.Sc.(Hons)
Lead Veterinarian - Pacific Region
Fisheries and Oceans Canada | Pêches et Océans Canada
Aquaculture Environmental Operations - Fish Health
Courtenay, British Columbia
Telephone | Téléphone: 250-703-0902
Fax | Télécopieur: 250-703-0921
Zac.Waddington@dfo-mpo.gc.ca

From: Burke, Julie (HC/SC) [<mailto:julie.burke@canada.ca>] **On Behalf Of** Emergency Drug Release / Distribution de médicament d'urgence (HC/SC)
Sent: July-12-18 9:36 AM
To: Waddington, Zac
Subject: Emergency Drug Release applications for Imvixa (10% lufenuron) use in BC

Good afternoon Dr. Waddington,

The Veterinary Drugs Directorate has received two applications from Cermaq Canada Ltd. for the treatment of Atlantic salmon smolt with Imvixa this fall in hatcheries in British Columbia. Some of the request details are provided in the table below:

DVM	Hatchery	Marine Sites	# fish	Quantity Imvixa	Time of transfer to sea
	Oceans	Ross Millar Saranac		30 kg	Oct / Nov
	Boot Lagoon	Ross Millar Saranac		30 kg	Oct / Nov

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s.20(1)(b)

Prior to authorizing requests for Imvixa, we confirm with a provincial representative that there is a significant sea lice infestation at the proposed marine sites, and that there are no concerns or objections to the treatment plan. Can you let us know whether or not you are in agreement with the veterinarian's proposals, or if you have any other comments.

Thank you,

Julie Burke, DVM
Acting Emergency Drug Release Officer

Emergency Drug Release, Veterinary Drugs Directorate
Health Canada / Government of Canada
hc.edr-dmu.sc@canada.ca / tel: 613-240-3916 / fax: 613-946-1125

Distribution de médicaments d'urgence / Direction des médicaments vétérinaires
Santé Canada / Gouvernement du Canada
hc.edr-dmu.sc@canada.ca / tél: 613-240-3916 / télécopie: 613-946-1125

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page 846

Waddington, Zac

From: Waddington, Zac
Sent: July-27-18 2:20 PM
To: Manchester, Howie
Subject: Statement of current sea lice problem document for FIAP
Attachments: Statement of current sea lice problem-FIAP.docx

I've been asked to speak to FIAP about what the issue is with the current state of affairs of sea lice mismanagement. I've been asked simply to outline the problem, but not to go into great detail about what steps we are taking/considering to rectify this. Can you please take a quick read over and ensure I haven't missed anything?

Dr. Zac Waddington DVM, B.Env.Sc.(Hons)
Lead Veterinarian - Pacific Region
Fisheries and Oceans Canada | Pêches et Océans Canada
Aquaculture Environmental Operations - Fish Health
Courtenay, British Columbia
Telephone | Téléphone: 250-703-0902
Fax | Télécopieur: 250-703-0921
Zac.Waddington@dfo-mpo.gc.ca

Statement of the Sea Lice Problem

- Documented SLICE resistance and subsequent treatment failures have occurred in numerous regions since 2013, affecting all three major Atlantic salmon farming companies
 - 2013- Klemtu
 - 2014- Quatsino
 - 2016- Esperanza
 - 2017- Clayoquot
- SLICE resistance is an emerging issue along BC's coast, and seems to develop rapidly, and spread widely throughout an area once it appears
 - The sole reliance on SLICE for lice management in an area is no longer feasible or precautionary
 - Companies should have the capacity and a plan in place to facilitate a rapid response to a SLICE treatment failure with an alternative treatment modality
- Risk factors for the development of SLICE resistance in a given area are currently under investigation by DFO and CFIA in a collaborative effort
- In lieu of SLICE (and often in response to treatment failure(s)) harvest has been used as a management tool under the COL to address lice exceedance during the outmigration
- A regulatory gap has been identified wherein farms have entered the outmigration and then used harvest as a management tool
 - Sometimes this is able to lower "absolute sea lice inventory" in accordance with 6.4 (a) of the COL, but other time not
 - Regardless, harvest does not quickly and sufficiently address sea lice numbers on farm so as to minimize spillover to wild salmon during the outmigration period
 - Without effective enforcement, companies have a perverse incentive to use harvest as a management tool during the outmigration, which meets the letter of the CoL, but certainly not the spirit or objective of preventing undue lice challenge to outmigrating smolts
- Harvest capabilities for a given company and area are generally full subscribed and there seems to be insufficient resilience in the harvest plan to accommodate the need for the rapid depopulation of a site
- The efforts made by industry to undertake area-based IPM are laudable and are encouraged by DFO
- DFO will support the licencing and implementation of alternative lice treatments wherever feasible
- DFO is reviewing our lice conditions to better fulfill our mandate of sustainable fisheries with regards to lice management

Waddington, Zac

From: McNabb, Melanie
Sent: August-03-18 9:12 AM
To: Waddington, Zac; Lavigne, Lauren
Subject: RE: edr application for imvixa

Thanks Zac, this is very helpful background. I'll file it with the application for reference.

Melanie McNabb
Governance Coordinator / Coordinatrice de la gouvernance
Fisheries and Oceans Canada, Pacific Region / Pêche et Océans Canada, région du pacifique
200 - 401 rue Burrard St., Vancouver, BC V6C 3S4
Tel / tél.: (604) 666-6894
Fax / téléc.: (604) 666-1076
e-mail / courriel : melanie.mcnabb@dfo-mpo.gc.ca

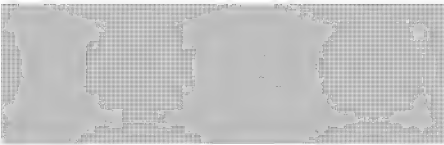
From: Waddington, Zac
Sent: August-02-18 2:43 PM
To: Lavigne, Lauren; McNabb, Melanie
Subject: FW: edr application for imvixa

If you read [REDACTED] letter to Health Canada for his EDR application you can see that he acknowledges Cermaq's inability to treat lice during the pre-out migration period. Therefore the situation will very likely and foreseeably result in another unmanageable out migration period in Clayoquot. That is the crux of his justification for the Emergency Drug Release (EDR) in the first place.

Zac

From: [REDACTED]
Sent: July-18-18 4:23 PM
To: Waddington, Zac
Subject: Fw: edr application for imvixa

FYI- thanks



s.19(1)

CERMAQ

Phone +1 250-286-0022
Direct +1 250-286-0022 ext [REDACTED]
Mobile [REDACTED]

Cermaq Canada Ltd.
203 - 919 Island Hwy
V9W 2C2 Campbell River, BC, Canada

Cermaq.ca [Facebook](#) [Twitter](#)

----- Forwarded by [REDACTED] on 18/07/2018 04 17 PM -----

From [REDACTED]
To "VDD EDR-DMV DMU" <VDDEDR-DMVDMU@hc-sc.gc.ca>
Cc [REDACTED]
Date 11/07/2018 04 25 PM
Subject edr application for imvixa

Hello,

Please find attached additional documents including: 1) EDR for Imvixa to be used at the Oceans Hatchery; 2) EDR for Imvixa to be used at the Boot Lagoon Hatchery; 3) A summary of sea lice counts, previous treatments, and bioassay results for the two previous production cycles at Ross, Millar, and Saranac; 4) Oceans Hatchery water usage; 5) Boot Lagoon Hatchery water usage; 6) Solids waste management for Cermaq Canada; 7) Depomod information for Ross; 8) Depomod information for Millar; 9) growth information for marine sites in Tofino. If you have any questions please contact myself at my cell phone or email below. If you cannot reach me please contact [REDACTED]

Sincerely,

[REDACTED]

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Waddington, Zac

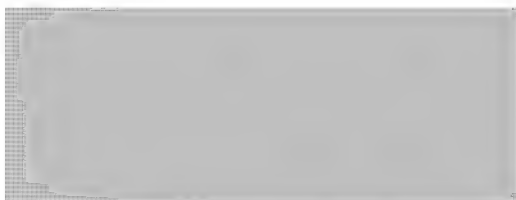
From: Waddington, Zac
Sent: August-02-18 2:43 PM
To: Lavigne, Lauren; McNabb, Melanie
Subject: FW: edr application for imvixa
Attachments: HC letter july 11 18.pdf; OH Imvixa EDR july 11 18.pdf; BLH Imvixa EDR july 11 18.pdf; Sea Lice count bioassay and treatment history.pdf; Oceans Water Usage Map.pdf; Boot Lagoon Water Usage Map 2018.pdf; Ross Pass 2x5 DEPOMOD Documentation Sep26 2014.pdf; Millar Ch 2x6 DEPOMOD Documentation Nov12 2012.pdf; Growth Curve Tofino.pdf

If you read [REDACTED] letter to Health Canada for his EDR application you can see that he acknowledges Cermaq's inability to treat lice during the pre-out migration period. Therefore the situation will very likely and foreseeably result in another unmanageable out migration period in Clayoquot. That is the crux of his justification for the Emergency Drug Release (EDR) in the first place.

Zac

From: [REDACTED]
Sent: July-18-18 4:23 PM
To: Waddington, Zac
Subject: Fw: edr application for imvixa

FYI- thanks



CERMAQ

Phone +1 250-286-0022
Direct +1 250-286-0022 ext [REDACTED]
Mobile [REDACTED]

Cermaq Canada Ltd.
203 - 919 Island Hwy
V9W 2C2 Campbell River, BC, Canada

Cermaq.ca [Facebook](#) [Twitter](#)

----- Forwarded by Barry Milligan/Ca/Mainstream/Cermaq on 18/07/2018 04 17 PM -----

From: [REDACTED]
To: "VDD EDR-DMV DMU" <VDD EDR-DMV DMU@hc-sc.gc.ca>
Cc: [REDACTED]
Date: 11/07/2018 04 25 PM
Subject: edr application for imvixa

s.19(1)

Hello,

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Sincerely,



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CERMAQ

Cermaq Canada Ltd 203-919 Island Highway
Campbell River, BC, V9W 2C2
Canada

Campbell River, 11 July 2018

To Whom it May Concern,

Hello,

We would like to apply for two Emergency Drug Releases to use the Imvixa in-feed product for the purposes of lice treatment in Atlantic salmon this fall. In particular we would like to apply for enough product to treat [REDACTED] fish at 90g coming from two hatcheries. From Oceans hatchery [REDACTED] fish at 90g will be entered into two sea sites (Ross – [REDACTED] Millar – [REDACTED]). From Boot Lagoon hatchery [REDACTED] fish also at 90g will be entered into the same two sea sites (Ross – [REDACTED] Millar – [REDACTED]). See Table with numbers, weights, and approximate dates. Note that one half of the smolt entries into Ross will end up being moved to a new site (Saranac) approximately 5 months post-entry.

All of the saltwater farms mentioned above are in the Tofino area of British Columbia. SLICE (emamectin benzoate) has been effective against sea lice in this area up until this previous spring. This past spring lice levels increased above the regulatory lice level of 3.0 motile lice / fish at these three sites due to failure of SLICE due to documented reduction in lice sensitivity to emamectin benzoate. Permits to use peroxide were applied for in the fall of 2017 but not made available until May of 2018 resulting in significant lice challenges in the region with levels as high as 55.0 motile lice / fish. Peroxide use in Tofino has been restricted to well boat use only by the provincial government due to community and environmental concerns. The affected sites mentioned above have since been harvested out and remaining sites in the area have been successfully treated with peroxide. All (3) well-boats capable of peroxide treatment on this coast are leased by either Marine Harvest or Grieg Seafood. Because sea lice treatments typically province wide occur from October through February which coincides with fish moves (due to limitations on well boats all of these boats are involved in both lice treatment, smolt entries, and large fish moves) we will not have access to well-boats for effective peroxide treatments even though we have permits to use peroxide in the Tofino area. In 2017 Cermaq commissioned an alternative sea lice treatment (a Hydrolicer) but because of ship-building limitations and time to acquire funding (12 million \$) this option will not be available until April 2019. Because of documented SLICE tolerance, an inability to secure well boat use for peroxide treatments, lack of alternative saltwater sites to receive fish, and an absent third lice treatment option (hydrolicer) before April 2019 Cermaq Canada is requesting the emergency release of Imvixa for use in British Columbia to help manage lice on fish due to be entered this fall.

Cermaq Canada Ltd.

203-919 Island Highway, Campbell River, BC
V9W 2C2 Canada

s.19(1)

s.20(1)(b)

+1 250 286-0022
www.cermaq.ca

Please find attached additional documents including: 1) EDR for Imvixa to be used at the Oceans Hatchery; 2) EDR for Imvixa to be used at the Boot Lagoon Hatchery; 3) A summary of sea lice counts, previous treatments, and bioassay results for the two previous production cycles at Ross, Millar, and Saranac; 4) Oceans Hatchery water usage; 5) Boot Lagoon Hatchery water usage; 6) Solids waste management for Cermaq Canada; 7) Depomod information for Ross; 8) Depomod information for Millar; 9) growth information for marine sites in Tofino. If you have any questions please contact myself at my cell phone or email below. If you cannot reach me please contact [REDACTED]

Smolt Date	Hatchery	Fish #	Smolt Sea Site	Grow Out Sea Site
Sep 30 - Oct 13	Oceans Hatchery Boot Lagoon Hatchery	[REDACTED]	Millar	Millar
Oct 14 - Oct 27	Oceans Hatchery Boot Lagoon Hatchery		Ross	Ross
Oct 28 - Nov 10	Oceans Hatchery Boot Lagoon Hatchery		Ross	Saranac
	Both Hatcheries Oceans Hatchery Boot Lagoon Hatchery			

Thank you for your consideration,

Kind regards

Cermaq Canada Ltd.

s.19(1)

s.20(1)(b)



**EMERGENCY DRUG RELEASE APPLICATION AND FEE FORM /
FORMULAIRE DE DEMANDE DE DISTRIBUTION DE MÉDICAMENTS D'URGENCE ET D'ÉTABLISSEMENT DES FRAIS**

Veterinary Drugs Directorate / Direction des médicaments vétérinaires
Holland Cross Complex, Tower A, Ground Floor, Address Locator : 3000A
Complexe Holland Cross, Tour A, Rez-de-chaussée, Indice de l'adresse : 3000A
14-11 Holland Avenue, Ottawa, ON K1A 0K9

Tel / Tél. : (613) 240-3916 Fax / Télécopieur : (613) 946-1125 Email: hc-edr-dmu.sc@canada.ca

Manufacturer Name & Address / Nom et adresse du fabricant Novartis Sante Animale S.A.S., Usine de Huningue, 26, Rue de la Chapelle, F-68330 Huningue, France		Tel/Tél. : _____ Fax/Télécopieur : _____
Drug Brand Name & Strength / Nom commercial & concentration du médicament Invixa 10%, Lufenuron 10%, oral powder		Active Ingredient / Principe actif Lufenuron
Quantity requested / Quantité demandée 30.0 kg premix	Clarify maximum for 6 month. / Clarifiez maximum pour 6 mois. 30.0kg premix	Date(s) drug will be used / Date(s) de l'utilisation du médicament Sep 30 to Nov 10, 2018
Dosage & Route of Administration / Posologie & voie d'administration 5mg/kg/day orally for 7 days		
Veterinary Practitioner Name & Address / Nom et adresse du vétérinaire Cernaq Canada Ltd, 203-919 Island Highway, Campbell River, BC V9W 2C2, Canada		Tel. / Tél. : _____ Fax / Télécopieur : 250-286-0042 E-mail / Courriel : _____
Billing address (if different) / Adresse de facturation (si différente)		Billing contact person / Personne ressource pour la facturation
Veterinary Situation, Disease, Justification / Justification de l'utilisation, maladie, diagnostic Lepeoptheirus salmonis infestation with reduced sensitivity to emamectin benzoate		
Species / Espèce Atlantic Salmon	Number of animals, age, weight, sex / Nombre d'animaux, âge, poids, sexe @ 89g	
Animal's Name and Owner's Name (for pets and horses) / Nom de l'animal et nom du propriétaire (pour les animaux de compagnie et les chevaux)		
Producer's Name and address, unit (for farms and/or breeding units) / Site de production, nom du producteur et adresse, unité (pour les fermes et/ou les centres d'élevage) Cernaq Canada Ltd		
Production Site (for aquaculture) / Site de production (aquaculture) Oceans Hatchery		
Previous follow-up report / Rapport de suivi précédent : has been sent / a été envoyé _____ is attached / est inclus _____ other (explain) / autre (explication) N/A		
If applicable, please provide a written statement that animals to which this drug is administered will not be used in food for human consumption. ***Si approprié, veuillez spécifier que les animaux auxquels ce médicament est destiné ne seront pas utilisés dans l'alimentation pour la consommation humaine.*** An EDR for a non food animal is \$50.00 ; for a food animal is \$100.00 ; you will be invoiced by Health Canada for your EDR request. / Une DMU pour un animal non destiné à l'alimentation coûte \$50.00 et \$100.00 pour un animal destiné à l'alimentation. Santé Canada vous fera parvenir une facture relativement à votre demande de DMU.		

VETERINARIAN'S SIGNATURE: _____

DATE: July 11, 2018

HC use only / À l'usage exclusif de la SC	EDR no. / No. de la DMU	NF F
Customer no. / No. De Client	Invoice no. / No. de la facture	S.O. no / No. d'engagement

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Health Canada Santé Canada

EMERGENCY DRUG RELEASE APPLICATION AND FEE FORM /
FORMULAIRE DE DEMANDE DE DISTRIBUTION DE MÉDICAMENTS D'URGENCE ET D'ÉTABLISSEMENT DES FRAIS

Veterinary Drugs Directorate / Direction des médicaments vétérinaires
Holland Cross Complex, Tower A, Ground Floor, Address Locator : 3000A
Complexe Holland Cross, Tour A, Rez-de-chaussée, Indice de l'adresse : 3000A
14-11 Holland Avenue, Ottawa, ON K1A 0K9

Tel. / Tél. : (613) 240-3916 Fax / Télécopieur : (613) 946-1125 Email: hc.edr-dmu.sc@canada.ca

Manufacturer Name & Address / Nom et adresse du fabricant Novartis Sante Animale S.A.S., Usine de Huningue, 26, Rue de la Chapelle, F-68330 Huningue, France		Tel / Tél. : _____ Fax / Télécopieur : _____
Drug Brand Name & Strength / Nom commercial & concentration du médicament Invixa 10%, Lufenuron 10%, oral powder		Active Ingredient / Principe actif Lufenuron
Quantity requested / Quantité demandée 30.0 kg premix	Clarify maximum for 6 month. / Clarifiez maximum pour 6 mois. 30.0kg premix	Date(s) drug will be used / Date(s) de l'utilisation du médicament Sep 30 to Nov 10, 2018
Dosage & Route of Administration / Posologie & voie d'administration 5mg/kg/day orally for 7 days		
Veterinary Practitioner Name & Address / Nom et adresse du vétérinaire Cermaq Canada Ltd, 203-919 Island Highway, Campbell River, BC V9W 2C2, Canada		Tel. / Tél. : _____ Fax / Télécopieur : 250-286-0042 E-mail / Courriel : _____
Billing address (if different) / Adresse de facturation (si différente)		Billing contact person / Personne ressource pour la facturation
Veterinary Situation, Disease, Justification / Justification de l'utilisation, maladie, diagnostic Lepeoptheirus salmonis infestation with reduced sensitivity to emamectin benzoate		
Species / Espèce Atlantic Salmon	Number of animals, age, weight, sex / Nombre d'animaux, âge, poids, sexe @ 88g	
Animal's Name and Owner's Name (for pets and horses) / Nom de l'animal et nom du propriétaire (pour les animaux de compagnie et les chevaux)		
Producer's Name and address, unit (for farms and/or breeding units) / Site de production, nom du producteur et adresse, unité (pour les fermes et/ou les centres d'élevage) Cermaq Canada Ltd		
Production Site (for aquaculture) / Site de production (aquaculture) Boot Lagoon Hatchery		
Previous follow-up report / Rapport de suivi précédent : has been sent / a été envoyé _____ is attached / est inclus _____ other (explain) / autre (explication) N/A		
If applicable, please provide a written statement that animals to which this drug is administered will not be used in food for human consumption. ***Si approprié, veuillez spécifier que les animaux auxquels ce médicament est destiné ne seront pas utilisés dans l'alimentation pour la consommation humaine.*** An EDR for a non food animal is \$50.00; for a food animal is \$100.00; you will be invoiced by Health Canada for your EDR request. / Une DMU pour un animal non destiné à l'alimentation coûte \$50.00 et \$100.00 pour un animal destiné à l'alimentation. Santé Canada vous fera parvenir une facture relativement à votre demande de DMU.		

VETERINARIAN'S SIGNATURE: _____

DATE: July 11, 2018

HC use only / À l'usage exclusif de la SC	EDR no. / No. de la DMU	NF F
Customer no. / No. De Client	Invoice no. / No. de la facture	S.O. no / No. d'engagement

04.03.22

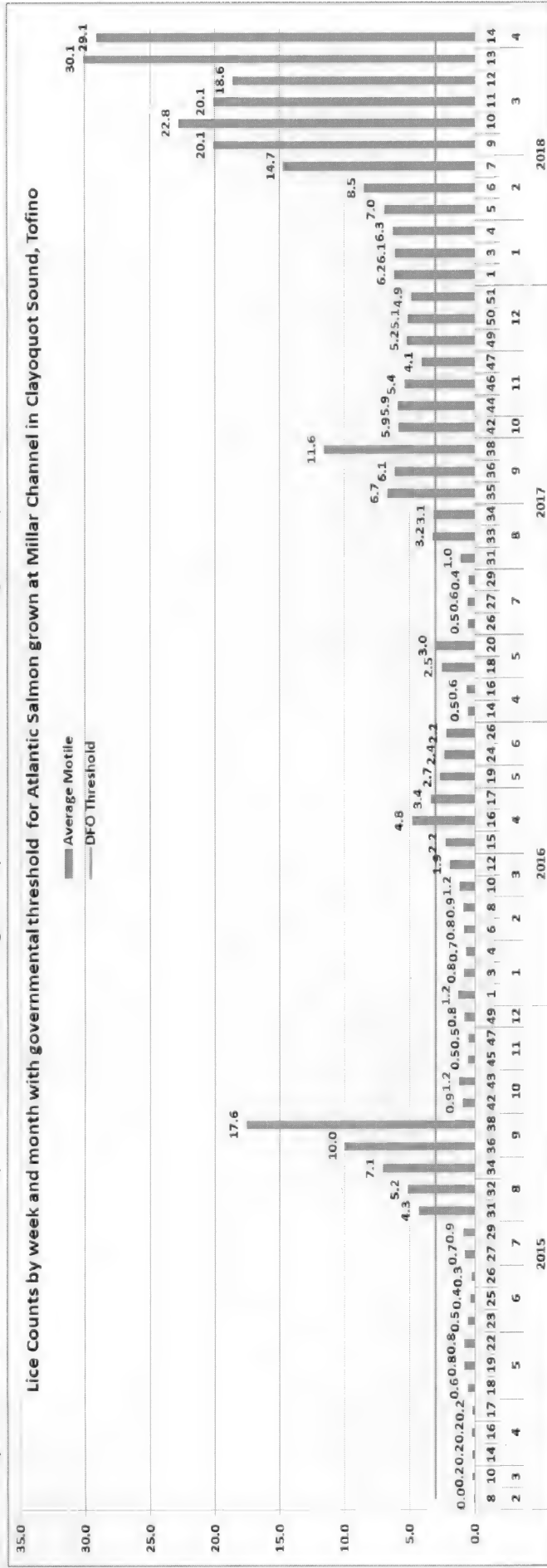
2 of 2

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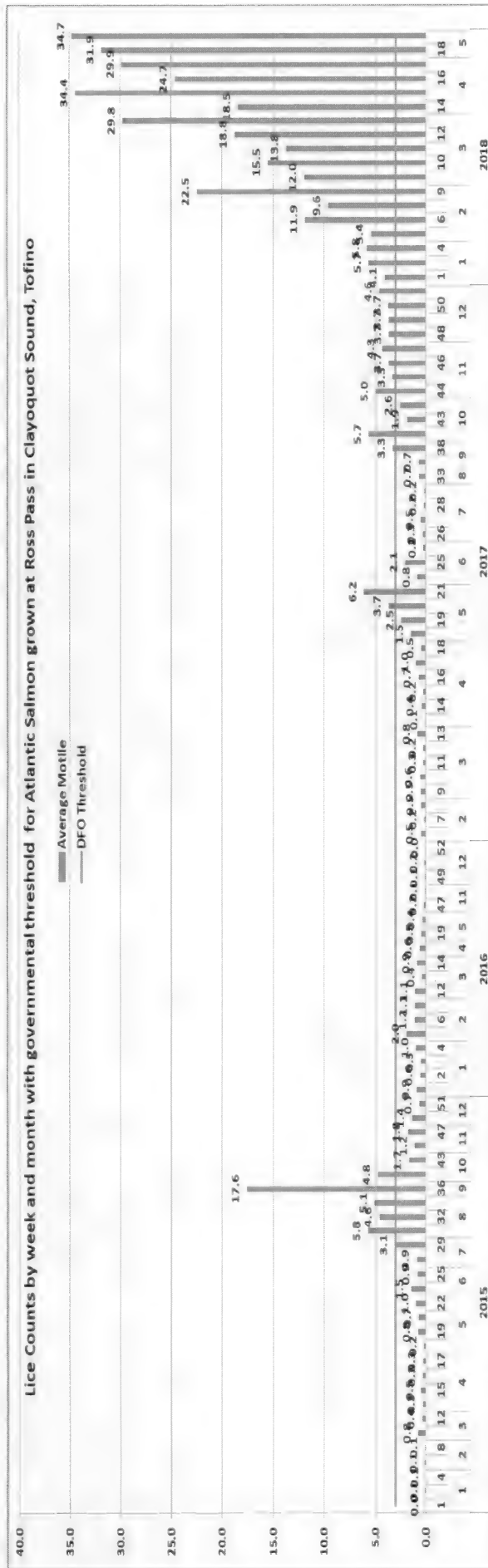
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Lice Count Summary;

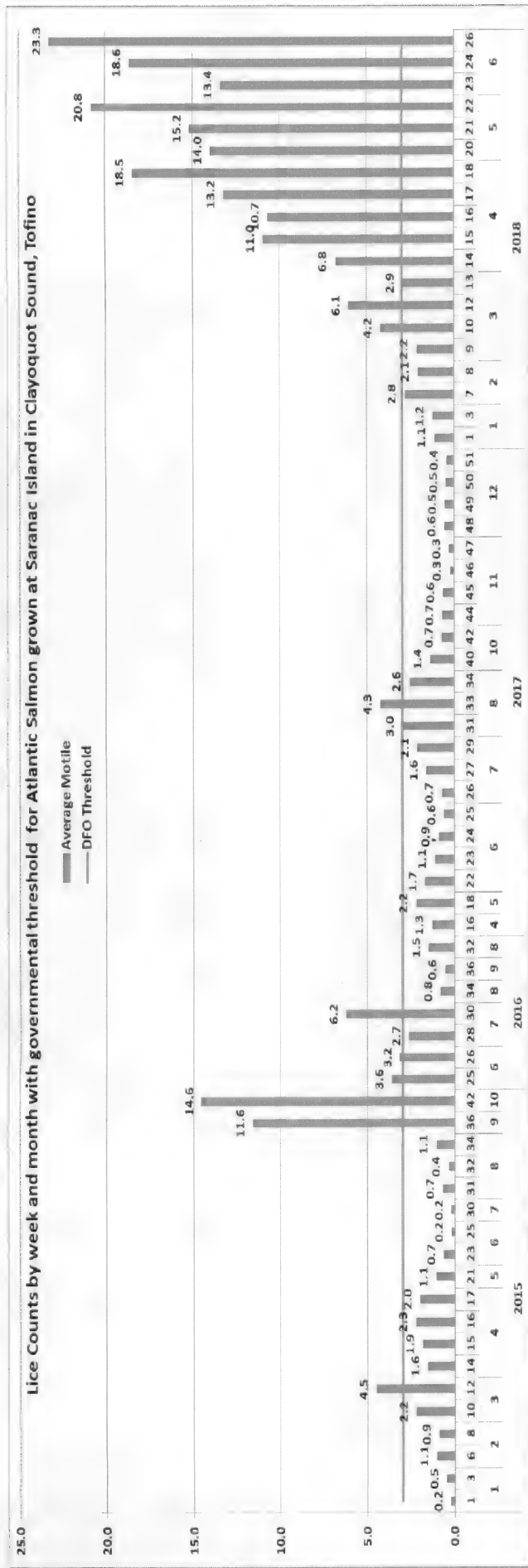
DFO requires a management action within 15 days if a site is over threshold limit during the sensitive period between March 1st and June 30th every year. No immediate action is required outside of the sensitive period, however, a management plan and increased monitoring are required.



The 2015YC at Millar Channel was entered in Dec 2014, harvested out July 2016. The 2017YC was entered in March 2017 from Ross Pass, harvested out April 2018. Treatments occurred in September 2015, April and May of 2016, June 2017 and September 2017 (see treatment summary, Table 1 for details).

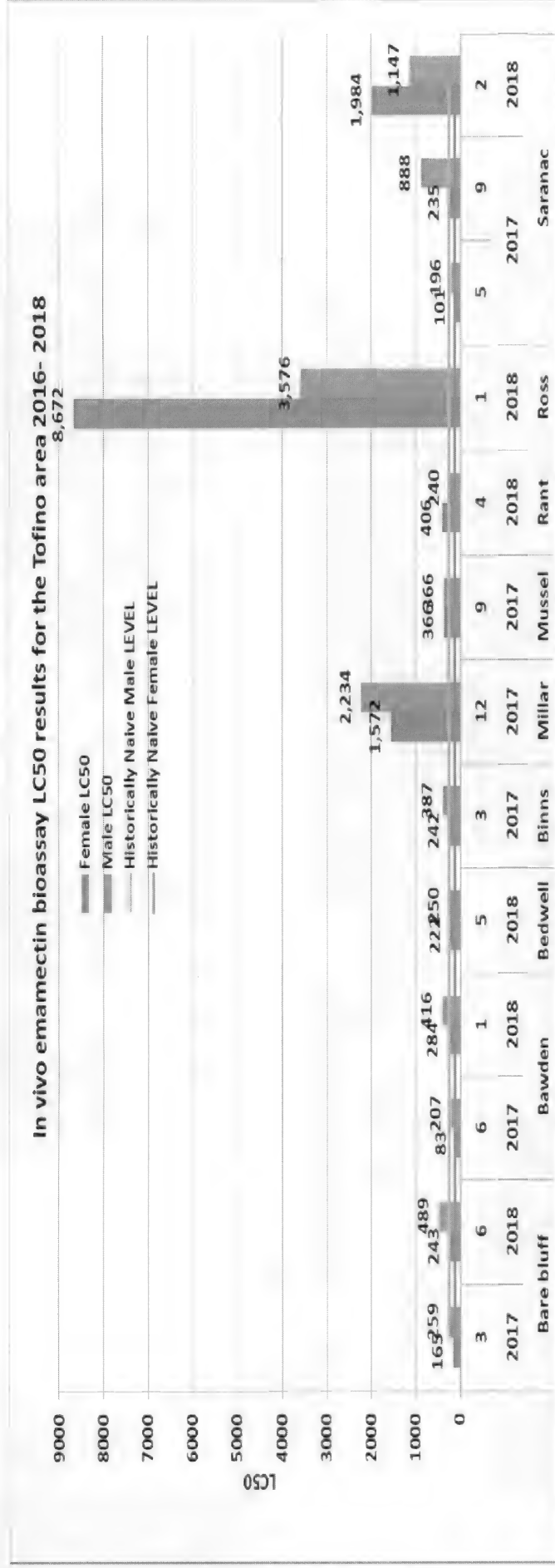


The 2015YC at Ross Pass was entered in Nov 2014, harvested out June 2016. The 2017YC was entered in Sep 2016, harvested out May 2018. Treatments occurred in September/October 2015, February 2016, June 2017 and October 2017 (see treatment summary, Table 1 for details).



The 2014YC at Saranac Island was entered in March 2014, harvested out November 2015. The 2016YC was entered in March 2016 and culled in September 2016 due to Net Pen Liver Disease. The 2017YC was entered in April 2017 and is scheduled to be harvested out by August of 2018. Treatments occurred in May 2015, July 2016, May 2017 and September 2017 (see treatment summary, Table 1 for details).

Bioassay Summary;



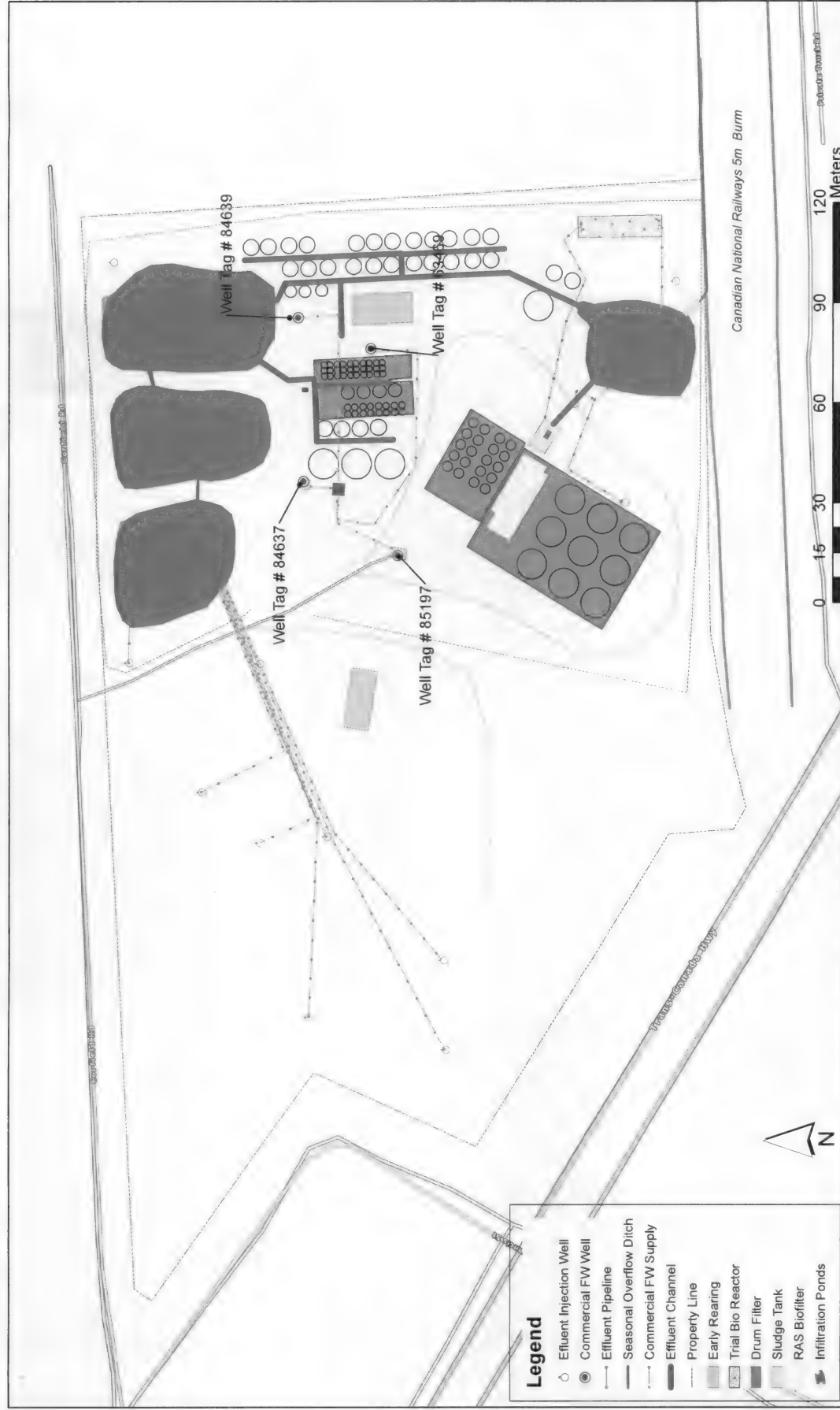
Bioassays are conducted prior to use of emamectin benzoate. Lice are collected on site and transported live to the lab where the in vivo bioassay is completed. A minimum of 30 lice per concentration and sex are used in each assay.

Treatment History;

Table 1. Treatment summary for the last two completed year classes at all three sites.

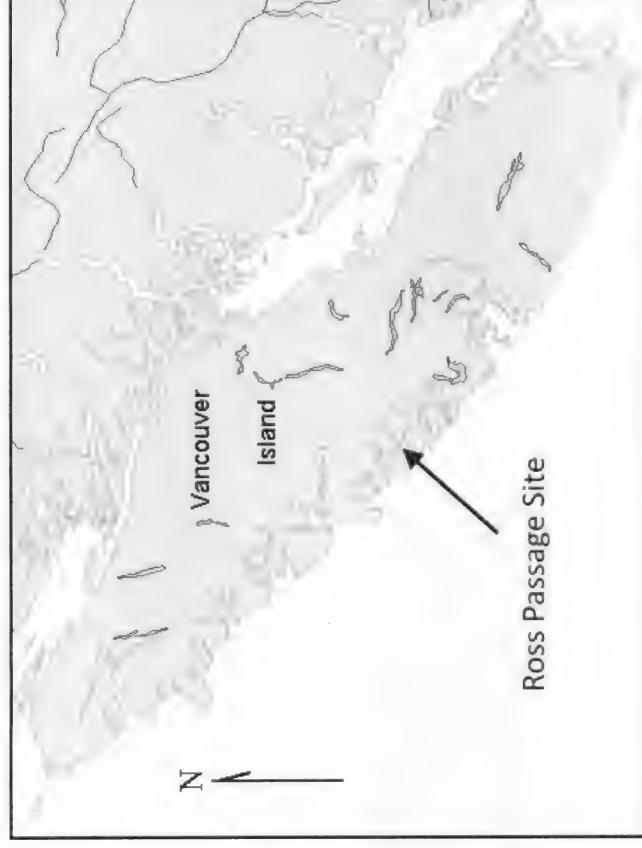
Start Date	End Date	Site	Year Class	Drug	Diagnosis	# Days	Feed Size	Prescription #	Year	Month (End of Tx)	Quarter	Feed Quantity (kg)	Inclusion rate per tonne (g)	Active Ingredient (kg)
02-May-15	10-May-15	Saranac	2014	Emamectin Benzoate	Sea Lice	7	XL	15-40	2015	5	2	78,000	8.24	0.643
21-Sep-15	30-Sep-15	Millar	2015	Emamectin Benzoate	Sea Lice	7	L	15-88	2015	9	3	52,000	7.68	0.399
30-Sep-15	06-Oct-15	Ross	2015	Emamectin Benzoate	Sea Lice	7	L	15-90	2015	10	4	46,000	8.89	0.409
21-Feb-16	27-Feb-16	Ross	2015	Emamectin Benzoate	Sea Lice	7	XL	016-031BM	2016	2	1	47,880	14.30	0.685
21-Apr-16	29-Apr-16	Millar	2015	Emamectin Benzoate	Sea Lice	9	XL	016-046bBM	2016	4	2	21,000	12.50	0.263
12-May-16	18-May-16	Millar	2015	Emamectin Benzoate	Sea Lice	7	XL	016-046cBM	2016	5	2	21,700	12.50	0.271
20-May-16	27-May-16	Millar	2015	Emamectin Benzoate	Sea Lice	8	XL	016-046dBM	2016	5	2	21,910	12.50	0.274
21-Jul-16	27-Jul-16	Saranac	2016	Emamectin Benzoate	Sea Lice	7	4.5mm	016-074BM	2016	7	3	12,075	5.00	0.060
13-May-17	20-May-17	Saranac	2017	Emamectin Benzoate	Sea Lice	7	4.5mm	017-078BM	2017	5	2	37,100	5.60	0.208
2-Jun-17	8-Jun-17	Millar	2017	Emamectin Benzoate	Sea Lice	7	6.5mm	017-082BM	2017	6	2	49,840	5.00	0.249
2-Jun-17	9-Jun-17	Ross	2017	Emamectin Benzoate	Sea Lice	7	6.5mm	017-083BM	2017	6	2	45,570	5.00	0.228
16-Sep-17	22-Sep-17	Saranac	2017	Emamectin Benzoate	Sea Lice	7	L	017-119BM	2017	9	3	75,250	7.10	0.534
21-Sep-17	27-Sep-17	Millar	2017	Emamectin Benzoate	Sea Lice	7	L	017-121BM	2017	9	3	78,540	6.30	0.495
1-Oct-17	7-Oct-17	Ross	2017	Emamectin Benzoate	Sea Lice	7	L	017-137BM	2017	10	4	47,390	7.70	0.365

Ocean Farms Hatchery Site Map CERMAQ





DEPOMOD Documentation for
Cermaq Canada Ltd. Ross Pass Site
Clayoquot Sound
Current Operation: 2 x 5 Pens Configuration



September 26, 2014

1.0 DEPOMOD prediction of waste distribution

DEPOMOD (DEPOMOD v 2.2 Jan. 2001,:) was used to predict the distribution of wastes at the Ross Pass site (Figure 1) for Cermaq Canada Ltd.. DEPOMOD is a model developed in Scotland (Cromey *et al.*, 2002a) to assist in location of fish farms and in the regulatory process by predicting the waste accumulation on the seabed arising from fish farms.

DEPOMOD uses local currents, bathymetry, pen location and size and feed quantities to predict the extent of distribution or "footprint" of the farm wastes as total solids or as organic carbon calculated over a period of time or as fluxes (fluxes were predicted for the Ross Pass site for maximum and average feed). Information on the models and field validation are presented by Cromey *et al.* (2002a and b).

The model consists of a series of modules or sub-models

- A grid development module with depth/ pen, etc. location
- a particle tracking model
- a resuspension/organic decay module (resuspension was not used)
- a semi-empirical benthic impact module (not used)

It has been noted that aspects requiring further investigation include application of the model at depths greater than about 70 meters and areas and/or with steep depth gradient (C. Cromey at BCARDC Workshop on Wastes, Nov. 25&26, 2003). The model is undergoing validation in BC conditions. Modeling has been undertaken by IEC to the best of our ability using supplied data and information and DEPOMOD Version 2.2. It should be noted that the results are estimates only and subject to the above conditions and limitations.

Current meters were deployed at the site and collected data May 14 to June 20, 2014. Modeling using DEPOMOD has been undertaken in September, 2014 using 30 days of the collected current data and reported in the present document.

For the Ross Pass site, Table 1 presents inputs used for DEPOMOD, Figure 1 indicates the grid area used in the model and Figures 2 and 3 present the flux predictions without resuspension for the period of maximum feed input and for average feed input. Surface areas of various contour levels (grams of carbon per square meter per day) of predicted footprint based on maximum and average feeding are shown in Table 2. Mass balance calculations to determine the quantity and percent of waste material that were predicted to be deposited within the model area are included in Table 3. Hydrographic information is summarized in Section 2 below.

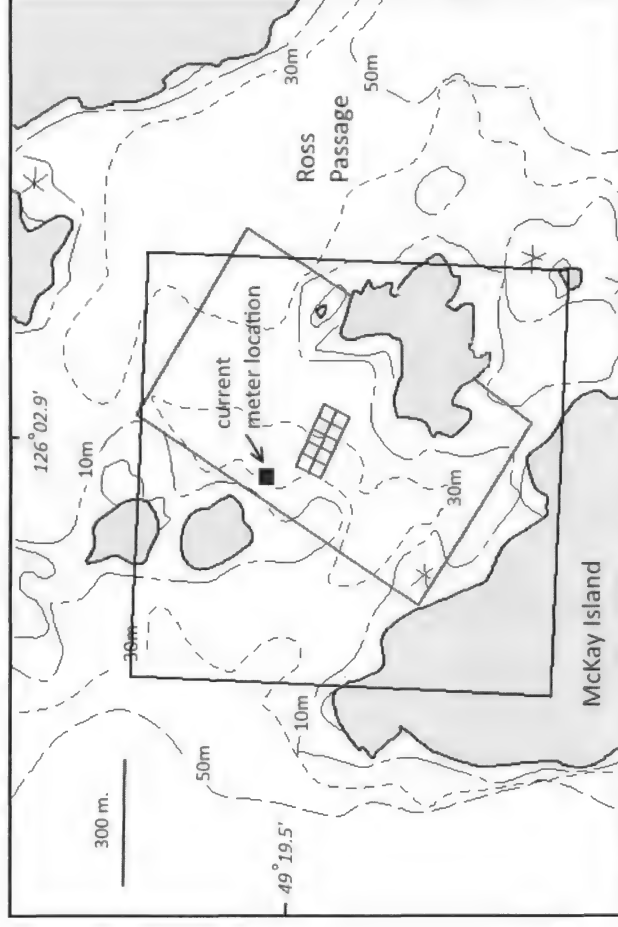


Figure 1. Diagram indicating 1000 by 1000 meter grid area used in DEPOMOD (black) at the Ross Pass site, tenure boundary (blue), pen location (blue) and current meter location.

Table 1. Site and input factors used with DEPOMOD for prediction of probable footprint at the Cernaq Canada Ltd. Ross Pass site (2x5 pens) September, 2014.

Site Name:	Ross Pass
Company:	Cernaq Canada Ltd.
Location:	49 deg 19.521' 126 deg 02.975'
Land File #:	1405933
Pens	
Number and type of Cages	10 square pens
Dimensions of net cages (m)	Pen Length: - 30m
	Pen Width - 30m
	Pen Depth: - 15m
Groups of net cages and orientation	2 rows of 5 pens at 115 Deg T along length
Longitudinal spacing between cage centres (m):	32m Distance
Transverse spacing between cage centres (m):	33m
Surface area of cages (m²)	~900*10 =9000 m ²
Coordinates of first cage centre by group (UTM or lat/long):	49 deg 19.458' 126 deg 02.961'
	49 deg 19.475' 126 deg 02.951'
Feed and Grow-out	
Maximum Daily Feeding Rate (kg/day):	Feed input/pen at peak feed volume: 940kg/day @ 15 months
Average Daily Feeding Rate over the grow-out period (kg/day):	Average feed input/pen: 520 kg/day
Total feed budget for grow-out period (tonnes)	3,051 tonnes
Approx. Farm production	
Duration of grow-out period (months)	
Hydrographic:	
Current meter mooring location (UTM or lat/long):	49 deg 19.521' 126 deg 02.975' NAD83
Height of Mean Water Level above chart datum (m)	2.15m (Riley Cove)
Depth at cage group position	20 to 40 m (from bathymetry depth)
Number of current velocity data sets used	2
Heights of mooring above sea bed	5.18 m
Depth of water column at mooring	33m
Length of current velocity record	30 days
Sampling interval (mins)	30 min converted to hourly with DFO-provided tool (courtesy Jon Chamberlain)
Time step of data used in model	60 min
Total number of time steps used in model	720
Mooring position	70 m at 340 degrees T from the N corner of pens

s.20(1)(b)

Table 1 Contd.

Bathymetry from	<ul style="list-style-type: none"> - From bathymetry provided as 25m grid by Ocean Dynamics Canada Ltd. and Coast Spatial GIS & Mapping Specialists. (The DGPS receiver used for the bathymetric survey is a Trimble Pro XRB; sonar is a high end Lowrance X-15 with custom software supplied by Lowrance and a custom transducer capable of 2400 feet in salt water; boat speed of 1 - 2.5 meters/second yields a maximum distance of 4 to 5 meters between soundings; transects are generally 10 meters apart within the actual lease boundary and 15 meters apart outside the boundary; 2004 info; areas outside boundaries may be supplemented by CHS data as necessary)
Modeling:	
Area	<ul style="list-style-type: none"> - $x = 1000m; y = 1000m$
Grid Origin	- 713905 5467132 UTM9 NAD83
Major Grid/ Minor Grid sizes	- 25x25m/ 10x10m
Food water content	- 10%
Digestibility of feed	- 90%
% Carbon in feed	- 57%
% Carbon in faeces	- 33%
Food wasted as % of food fed	- 3%
Food particle settling velocity distribution	- 11.0cm/s
Faecal particle settling velocity distribution	- 3.2cm/s SD 1.1 cm/s
Turbulence Model	- Random Walk
Horizontal dispersion coefficients	- $0.1 m^2/s$
Vertical dispersion coefficient	- $0.001 m^2/s$
Trajectory evaluation accuracy	- High 60s
Number of particles used	- 10
Resuspension Model/ Options	- OFF
Other Models	- Not used
Output	- Flux (grams $C/m^2/year$; calc. to /day)

Contact regarding model simulations



s.19(1)

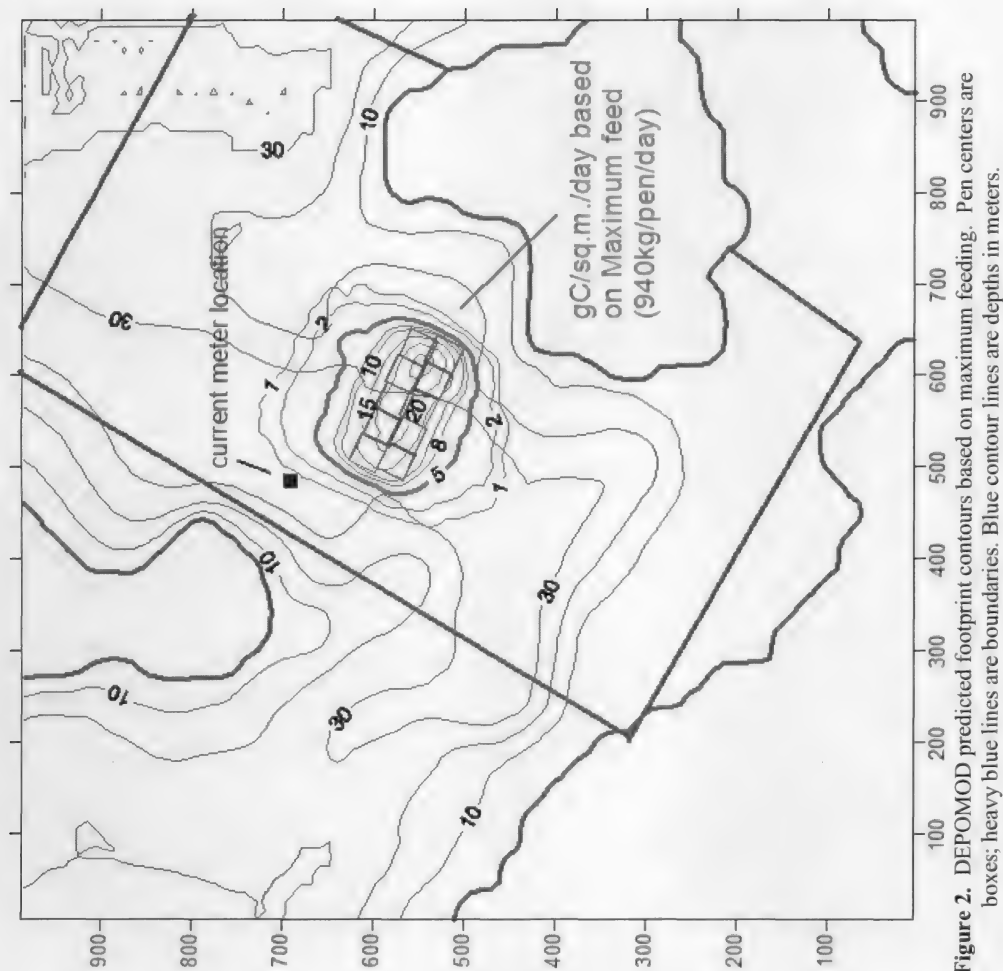


Figure 2. DEPOMOD predicted footprint contours based on maximum feeding. Pen centers are boxes; heavy blue lines are boundaries. Blue contour lines are depths in meters.

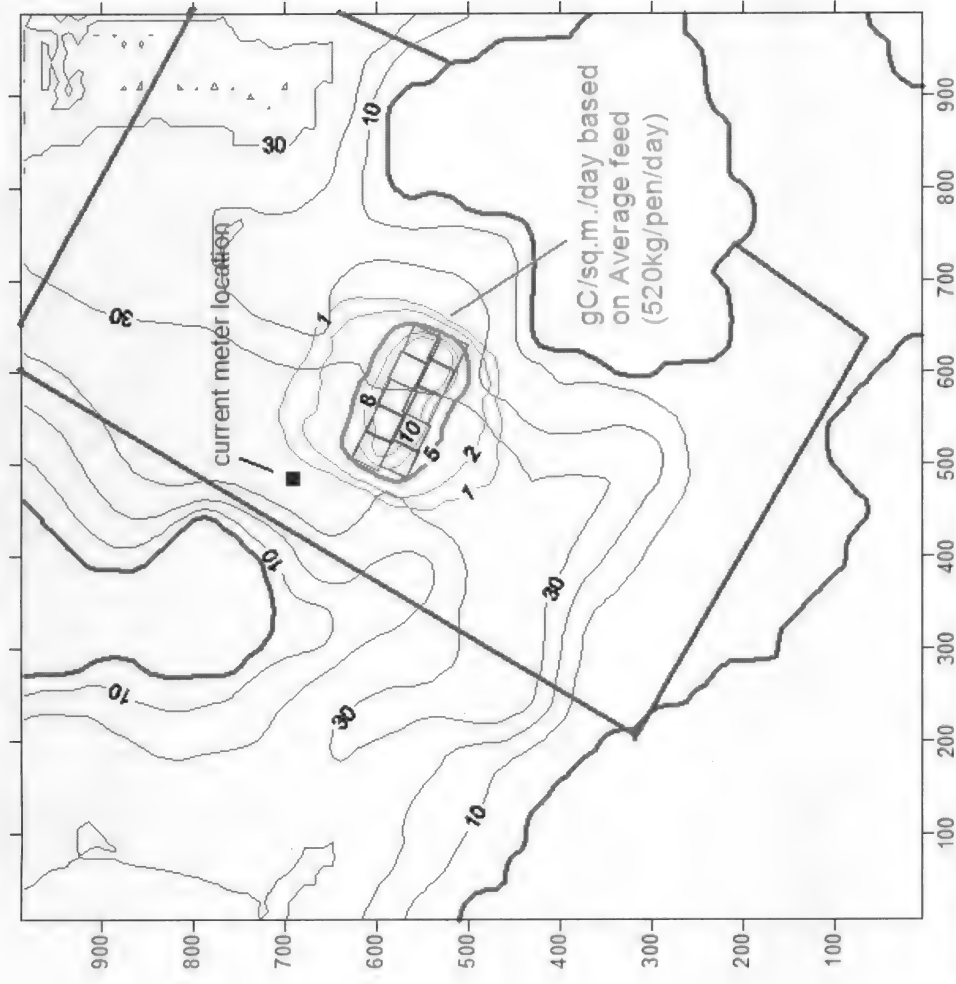


Figure 3. DEPOMOD predicted footprint contours based on average feeding. Pen centers are boxes; heavy blue lines are boundaries. Blue contour lines are depths in meters.

Table 2. Surface area of predicted footprints contours based on maximum (above) and average (lower) feeding

Maximum Feed		No Resuspension	
gC/sq.m./day		Surfer	
		Positive Planar Area [cut] (sq.m.)	
1	52,297		
2	40,852		
5	25,047		
8	17,449		
10	14,556		
15	9,225		
20	4,472		
30	0		

Table 3. Mass balance calculations for the Ross Pass site to determine the quantity and percent of material deposited within the model area based on maximum (upper) and average (lower) feeding. (method used as in DCP150 - DFO Marine Fish Habitat Information Requirements for Finfish Aquaculture Projects).

Maximum feed		No Resuspension	
Surfer Positive Volume [cut] value/day in grid area		415,199 g C	
feed per pen/day/pen (kg)	# pens	10	
	or	940 kg	
	total feed, all pens	940,000 g	
	X	0.044	
feed X 0.044 (C calc. as in method)		413,600 g C	
C deposited in grid area as % of expected from feed		100.4%	
Average feed		No Resuspension	
Surfer Positive Volume [cut] value/day in grid area		229,685 g C	
feed per pen/day/pen (kg)	# pens	10	
	or	520 kg	
	total feed, all pens	520,000 g	
	X	0.044	
feed X 0.044 (C calc. as in method)		228,800 g C	
C deposited in grid area as % of expected from feed		100.4%	

2.0 Hydrographic Data

Information about the current meters and their location and deployment is presented in Table 4.

Table 4. Current meter and deployment information.

Equipment	
Meter(s):	<ul style="list-style-type: none"> - Nortek Aquadopp Current Profiler: Aquapro 400khz (see Figure 4 for specification sheet) - Serial Number: AQD4876 - Last calibration and servicing – May 7, 2008
Current Meter Deployment	
Meter location:	<ul style="list-style-type: none"> - Cernmaq Canada Ltd. Ross Pass site at a location 70 meters at 340 degrees T from the N corner of pens - 49 deg 19.521' 126 deg 02.975' NAD83; see Figure 5). - For the site, Magnetic North = 17.2 degrees True
Magnetic declination	
Depth at location:	- 33 meters
Tidal range:	- 4.4 meters based on Riley Cove current station
Mean Water Level:	- 2.15 meters based on Riley Cove current station
Meter recording	- surface (15meter depth)
Depths:	- near-bottom (5 meters above the sea floor at 28 meters depth)
Record type:	<ul style="list-style-type: none"> - sample current speed and direction at 30-minute intervals over 30 days - averaging - 2 minutes - see figure 6 for description
Averaging period:	
Mooring:	
Start:	- 00:00 PST (UTC-8) May 14, 2014 (as used in Depomod)
End:	- 23:30 PST (UTC-8) June 12, 2014 (as used in Depomod)
Number of data points:	- 1,440
Deployed by:	- Ocean Dynamics

Data Analysis

The data is normally reviewed using Textpad program and data collected before deployment and/or after retrieval is deleted for use. Pre and post-retrieval data is determined from field records and is normally also evident in sharply increased or decreased (depending on surface air temperature) temperature readings and/or in conjunction with other changed readings, depending on the type of meter. Data is further evaluated for any evident problems. If the data appears satisfactory, Magnetic current direction data is converted to True based on variation from Geomagnetism Magnetic declination calculator (<http://geomag.nrcan.gc.ca/apps/mdcal-eng.php>) using an Excel program created by IEC for the purpose (for the site, Magnetic North = 17.2 degrees True). Analysis took place on the 30 days of data collected at 30 minute intervals (averages over 2 minute period every 30 minutes). An Excel file was used to produce and output the current speed/ direction array. The array is copied to an Excel file that uses the data to provide tabular and graphic summaries of the current speed and direction for the data.

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Results are presented in Tables 5 to 7 and Figures 5 and 7 to 18. A toolkit provided by DFO (courtesy of Jon Chamberlain) at a July/04 DEPOMOD workshop to aid in the visual analysis of hydrographic data has been used to prepare Figures 9 to 18 for review.

Table 5. Average current speed and direction for the 30 day period including 1440 records. Note that average direction does not indicate dominant direction(s) in all cases.

Average direction (Deg T)	Top		Bottom	
	4.0	283.8		
Speed cm/s				
	Max	28.8	23.5	
	Min	0.4	0.3	
	Average	9.2	7.0	
% of time > 5cm/s		79%	67%	

The Ross Passage site is within an irregular passage area with several islands and rocky areas. Upper (15m depth) currents recorded showed general trends roughly to the NE and SW along the nearby upper depth contours; lower currents (28m depth) were more variable in direction but with some N and S trends, possibly due to corresponding deeper bathymetry. Current speeds recorded were slightly higher at the upper depth.




Aquadopp® Profiler

A small and light current profiler for coastal measurements

Longer range with 400 kHz

The Aquadopp® profiler measures the current profile in water using acoustic Doppler technology. It is designed for stationary applications and can be deployed on the bottom, on a mooring rig, on a buoy or on any other fixed structure. It is a complete instrument and includes all the parts required for a self contained deployment with data stored to an internal data logger. Typical applications include coastal studies, online monitoring and scientific studies in rivers, lakes, and channels.

The Aquadopp® profiler uses three acoustic beams slanted at 25° to accurately measure the current profile in a user selectable number of cells. The internal tilt and compass sensors tell the current direction and the high-resolution pressure sensor gives the depth—and the tidal elevation if the system is fixed mounted. The standard 9 MB recorder and internal alkaline batteries are typically sufficient for a 2–4 month deployment.

Deployment times can be increased or sampling schemes intensified by expanding to 16 MB memory and external batteries.

Go one step further into the system and you will find a host of new features:

- ✓ Small blanking distances give you data close to the instrument
- ✓ Small cell sizes even in high flows
- ✓ Compass and tilt data automatically senses up or down orientation (use the profiler either way)
- ✓ Adjustable power output reduces battery consumption in shallow water
- ✓ All plastic and titanium parts, from 2.4 kg in air
- ✓ Flexible transducer design—order special heads at low additional cost
- ✓ Powerful AquaPro Win32™ software for trouble free deployment planning, recording, data retrieval, and ASCII conversion
- ✓ Online data communication via radio modem
- ✓ Collect directional wave data at 1 Hz or 2 Hz in between current profiles
- ✓ Inquire for deep water versions

Wave Directional Data

The Aquadopp can be configured to collect 1 Hz or 2 Hz wave data (p.u.v) interleaved with the mean current profile. The 1 Hz or 2 Hz data allow you to calculate the wave height, period, and direction, either using Nortek add-on wave software or your own algorithms. The instrument is best suited for wave measurements in areas with long waves (Tp > 4–5 s). For other areas or for long-term online measurements, we suggest looking at the AWAC as an alternative.

Third Generation Current Profiler

Nortek is proud to be the first company that introduced a third generation current profiler. The first generation was the original ADCP, a bulky and expensive, but revolutionary instrument first introduced in 1982. The second

www.nortek.no

Figure 4. Specifications for Aquadopp Current Profilers from website: www.nortek.no.

Specifications

Water velocity measurements
Acoustic frequency 0.4MHz, 0.6MHz, 1.0MHz, 2.0MHz
Maximum profiling range* 30-90m 12-20m 4-10m
Cell size 2-6m 1-4m 0.3-4m 0.1-2m
Minimum sounding depth 12m 0.5m 0.2m 0.05m
Velocity range 310m/s (call for extended range)
Accuracy 1% of measured value ± 0.5 cm/s
Max. sampling rate 1Hz
Velocity uncertainty Consult software program

*The Aquaprobe profiler measures the current profile in a user specified range of depths. The maximum range should be expected with clear water and small cells and the higher range with large cells and acoustically turbid water.

Echo intensity

Sampling rate Same as velocity
Dynamic range 90dB

Transducer

Frequency 0.4MHz, 0.6MHz, 1.0MHz, 2.0MHz
Number of beams 3, 7, 30, 34
Beam width 3°, 3°, 3°, 1.7°

Standard sensors

Temperature Thermistor embedded

Range -4°C to 30°C

Accuracy/resolution 0.1°C/0.01°C

Time response 10 min

Compass Flux gate with liquid tilt

Accuracy/resolution 30°

Tilt Liquid level

Accuracy/resolution 0.1°/0.1°

Pressure Automatic detect

Range 0-100m (standard)

Accuracy/resolution 0.25%/0.005% of full scale

Analog inputs 2

Number of channels Battery voltage. Hardware can be modified to provide 5V or 12V

Voltage supply 0-5V

Voltage input 16 bit A/D

Resolution

Serial data communication RS232, RS422

I/O Software supports most commercially available RS232 connectors

Baud rate 300-115200 (user setting)

Internal recording
Capacity 9MB, expandable to 31.8M or 161MB
Data record 31 bytes + 99 cells
Mode Stop when full (default) or wrap mode
Software "AquaPro"
Operating system Windows 95/98/NT
Functions Display, plot, print, data retrieval, ASCII conversion, online data collection, and graphical display

Power
DC input 9-16VDC
Max. average consumption at 1Hz 0.2-1.5W
Sleep consumption 0.0013W
Transient power 0.3-20W, 4 adjustable levels

Internal batteries
Type/energy 18 AA Alkaline cells/500Wh
New battery voltage 13.5VDC
Duration (10 minute avg) 80 days for 2MHz, 0.5m cells
Duration (10 minute avg) 50 days for 1MHz, 1.0m cells
Exact battery consumption and velocity uncertainty are complex functions of the deployment configuration. Please consult the Aquaprobe software for more exact predictions.

Materials
Standard Delrin and polyurethane plastics with titanium screws

Intermediate and deep water models Titanium and Delrin plastics

Connectors
Bulkhead (Impulse)

Cable
MCBH-8-FS
PVCIL-8-MP on 10-m polyurethane cable

Environmental
Operating temperature -5°C to 35°C
Storage temperature -20°C to 45°C
Shock and vibration IEC 71-2-2
Stallion water rating 300m

Dimensions
Weight in air 2.4kg/7.4kg (0.4MHz)/32.7kg (0.4MHz)

Length 550mm

Diameter 75mm

Options
Batteries Lithium, Li-Io rechargeable
Internal batteries 500Wh or 1200Wh
Bulkhead connectors Titanium or Delrin
Transducer head Right angle head for 1 or 2MHz.
Inquire for special configurations
Deep water systems Inquire for 2000-8 6000-m versions
Communication Request special harness for RS422

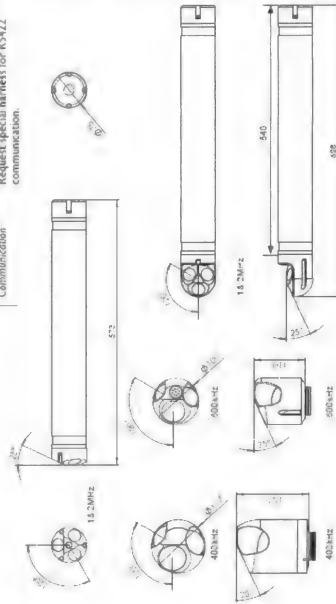


Figure 4 contd.

IEC International

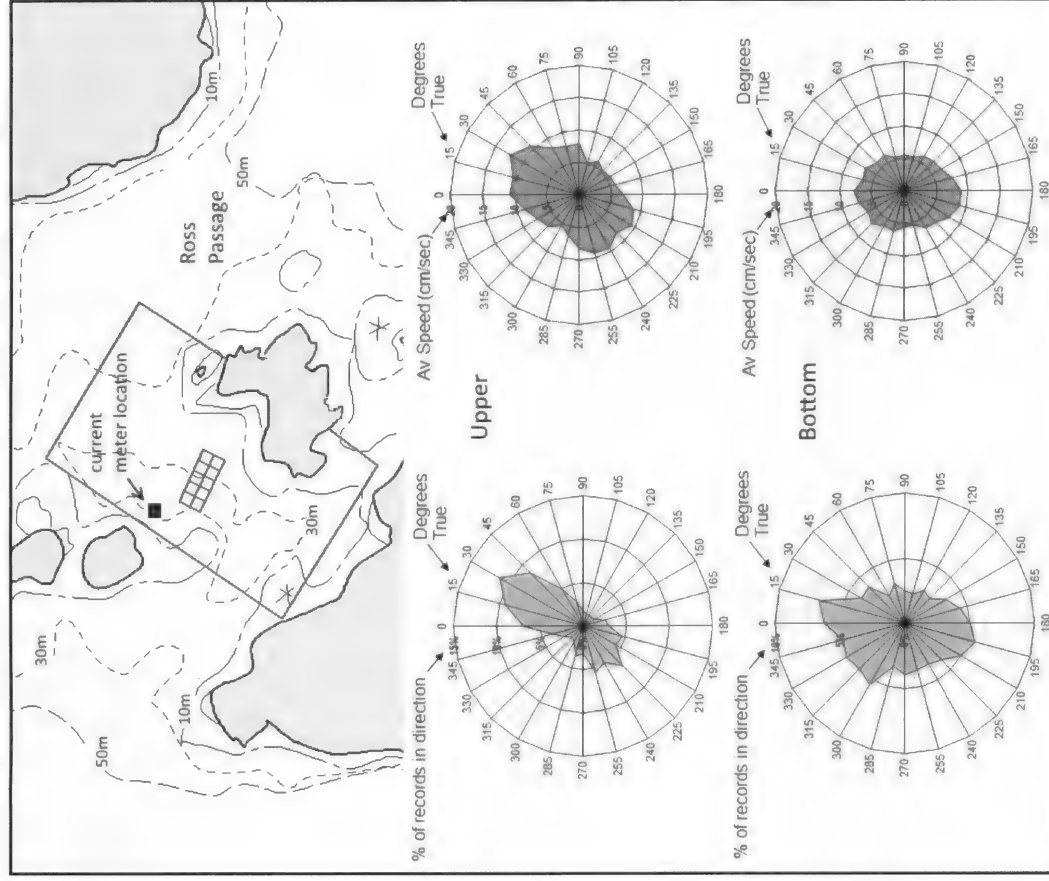


Figure 5. Diagram indicating relation of current measurements at the Ross Pass site for the May 14 to June 12, 2014 period. Average speed recorded and the percent of records in each direction (in which current flows) category are shown for the upper and lower meters. The site diagram has been aligned with true north at the top of the page as shown in the current graphs.

Current Profiler Schematic for Ross Pass June 2014.

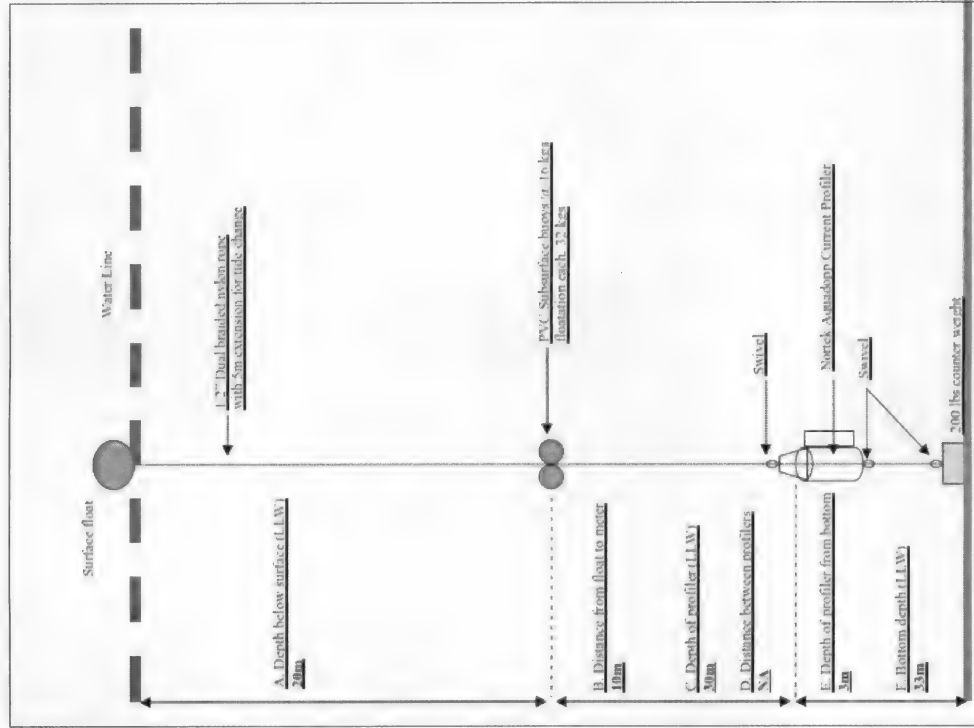


Figure 6. Diagram indicating anchoring and setup of current meters at site. Adapted from diagram courtesy of Ocean Dynamics.

Company Completing Assessment: Ocean Dynamics inc.



Current Meter Manufacturer and Model: Aquadopp Current Profiler

Serial Number: ΔOD 4876

Last calibration date: May 7, 2008

Last Service date: May 7, 2008

Deployment Date: 05/13/2014 Time: 11:30:00 AM
MM DD YYYY PDT

Recovery Date: 06/20/2014 Time: 08:00:00 AM
MM DD YYYY PDT

Mooring Location:
NAD-27 ☐ Latitude: 49 19.521
NAD-83 ☒ Longitude: 126 02.975

Sampling Interval:
Instantaneous: ☐ 2 Minutes
Averaging: ☒ 120 Samples
Subsurface Floatation: Description: Two 16kg hard floats
Floatation: 32 kg

Anchor:
Description: Five 18kg Cannon Balls
Weight: 90 kg

Mooring Materials Description
Location of swivels: indicated on diagram
Type of line: 1.2" dual braided nylon
Method of recovery: Lift from surface float
other: _____

Note:
if meter(s) were deployed in a way other than that of a standard sub-surface mooring, please provide an appropriate description of materials and configuration of the meter(s).

Table 6. Breakdown of sampled current data for the upper depth at 15 meter depth at the Ross Pass site for May 14 to June 12, 2014. Samples were taken every 30 minutes; each sample represents the average over a 2 minute period. The number of samples with speed and direction within ranges centered at the indicated numbers are shown.

Mooring Site: Ross Pass		Time(24h): Date(DMY)		Sample# (PST)									
Position:	Upper	Start:	0:00	14-May-07	1								
Deployment Location:		Final:	23:30	12-Jun-07	1440								
DGPS:		Total # of Samples:	1440										
Latitude: 49 deg 19.521'													
Longitude: 126 deg 02.975'													
Datum: NAD83													
Description: Ross Passage site													
Meter Depth:	15 Meters												
Bottom/ anchor depth:	33 Meters (corrected to meters below 0 tide)												
Instrument make: Aquadopp													
model: ADC current profiler													
serial #: 4876		Meter Calibration: May 7, 2008											
Records in :		Degrees True (Mag. North = 17.2 deg. True)											
Sample Interval: 30 Minutes													
Total # Measurements: 1440		(Sample is instantaneous)											
Contact re. deployment:		Aquamelix		Contact re. Reporting: IEC									
Direction Deg True	Speed (cm/sec)	3	5	7	10	15	20	30	50	100	150	200	sum %
0	0	9	5	24	26	24	12	0	0	0	0	0	6.9%
15	2	13	11	23	37	35	11	2	0	0	0	0	9.3%
30	4	6	14	17	36	56	25	3	0	0	0	0	11.2%
45	1	3	20	22	36	30	13	0	0	0	0	0	8.7%
60	2	10	11	15	20	11	2	0	0	0	0	0	4.9%
75	0	9	4	12	13	3	1	0	0	0	0	0	2.9%
90	0	5	5	4	8	2	1	0	0	0	0	0	1.7%
105	2	8	5	1	5	0	0	0	0	0	0	0	1.5%
120	0	7	4	5	5	0	0	0	0	0	0	0	1.5%
135	0	9	4	4	3	0	0	0	0	0	0	0	1.4%
150	2	6	5	6	5	0	0	0	0	0	0	0	1.7%
165	2	12	10	6	5	3	0	0	0	0	0	0	2.6%
180	1	6	12	11	13	0	1	0	0	0	0	0	3.1%
195	2	7	10	11	25	12	1	0	0	0	0	0	4.7%
210	0	2	12	11	23	15	0	0	0	0	0	0	4.4%
225	3	13	10	23	31	10	3	0	0	0	0	0	6.5%
240	1	6	12	13	20	13	5	0	0	0	0	0	4.9%
255	1	9	9	20	22	13	6	0	0	0	0	0	5.6%
270	1	7	6	11	13	7	1	0	0	0	0	0	3.2%
285	2	10	10	15	12	2	0	0	0	0	0	0	3.5%
300	1	12	6	6	4	1	0	0	0	0	0	0	2.1%
315	2	2	6	9	5	2	0	0	0	0	0	0	1.8%
330	0	8	6	6	12	3	0	0	0	0	0	0	2.4%
345	2	6	6	14	12	10	2	0	0	0	0	0	3.6%
sum %:	2.2%	12.8%	14.1%	20.1%	27.2%	17.5%	5.8%	0.3%	0.0%	0.0%	0.0%	0.0%	

s.19(1)

Table 7. Breakdown of sampled current data for the bottom depth at 28 meter depth at the Ross Pass site for May 14 to June 12, 2014. Samples were taken every 30 minutes; each sample represents the average over a 2 minute period. The number of samples with speed and direction within ranges centered at the indicated numbers are shown.

Mooring Site: Ross Pass		Time(24h): Date(DMY): Sample# (PST)												
Position: Bottom	Start: 0:00	14-May-07	1											
Deployment Location: DGPS:	Final: 23:30	12-Jun-07	1440											
Latitude: 49 deg 19.521'	Total # of Samples: 1440													
Longitude: 126 deg 02.975'														
Datum: NAD83														
Description: Ross Passage site														
Meter Depth: 28 Meters	33 Meters (corrected to meters below 0 tide)													
Bottom/ anchor depth:														
Instrument:	make: Aquadopp													
	model: AOD current profiler	Meter Calibration: May 7, 2008												
	serial #: 4876	(Mag. North = 17.2 deg. True)												
Records in :	Degrees True													
Sample Interval: 30 Minutes														
Total # Measurements: 1440	(Sample is instantaneous)													
Contact re. deployment:	Aquamatrix	Contact re. Reporting:	IEC											
Direction Deg True	Speed (cm/sec)	0	3	5	7	10	15	20	30	50	100	150	200	sum %
0	3	12	13	23	28	11	0	0	0	0	0	0	0	6.3%
15	5	19	22	24	21	8	0	0	0	0	0	0	0	6.9%
30	2	10	17	14	6	4	3	0	0	0	0	0	0	3.9%
45	2	11	15	17	11	1	0	0	0	0	0	0	0	4.0%
60	1	9	10	4	9	2	0	0	0	0	0	0	0	2.4%
75	1	15	12	13	5	0	0	0	0	0	0	0	0	3.2%
90	2	13	7	6	7	1	0	0	0	0	0	0	0	2.5%
105	2	9	12	8	2	0	1	0	0	0	0	0	0	2.4%
120	1	9	13	11	6	2	0	0	0	0	0	0	0	2.7%
135	1	7	11	10	9	1	0	0	0	0	0	0	0	3.7%
150	3	12	10	11	13	4	0	0	0	0	0	0	0	4.4%
165	2	11	14	13	11	13	0	0	0	0	0	0	0	5.1%
180	2	8	9	15	24	13	2	0	0	0	0	0	0	5.6%
195	4	9	10	14	25	16	3	0	0	0	0	0	0	5.0%
210	2	12	12	15	18	11	2	0	0	0	0	0	0	4.0%
225	2	12	15	13	9	4	2	0	0	0	0	0	0	3.6%
240	0	16	10	11	11	4	0	0	0	0	0	0	0	3.7%
255	3	17	8	19	5	1	0	0	0	0	0	0	0	4.0%
270	5	10	18	15	8	1	0	0	0	0	0	0	0	3.4%
285	3	14	8	9	11	4	0	0	0	0	0	0	0	5.4%
300	3	19	21	15	16	4	0	0	0	0	0	0	0	4.9%
315	2	5	17	27	16	4	0	0	0	0	0	0	0	5.2%
330	2	17	17	16	21	2	0	0	0	0	0	0	0	4.9%
345	4	11	11	20	17	8	0	0	0	0	0	0	0	4.9%
sum %:	4.0%	19.9%	21.7%	23.8%	21.5%	8.3%	0.9%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	

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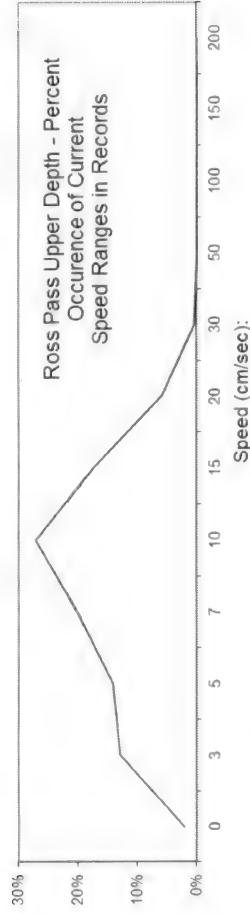


Figure 7. Percent occurrence of current speed for the upper depth 15 meters depth at the Ross Pass Site May 14 to June 12, 2014.

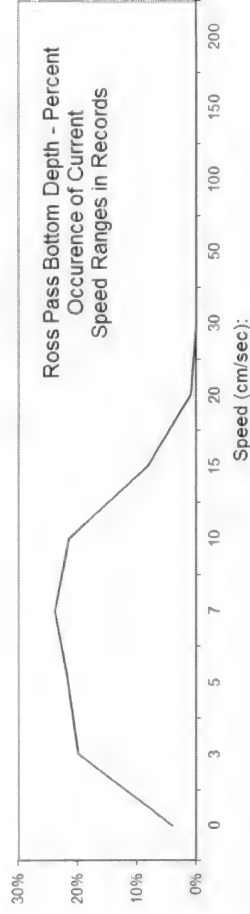


Figure 8. Percent occurrence of current speed for the lower depth at 28 meters at the Ross Pass Site May 14 to June 12, 2014.

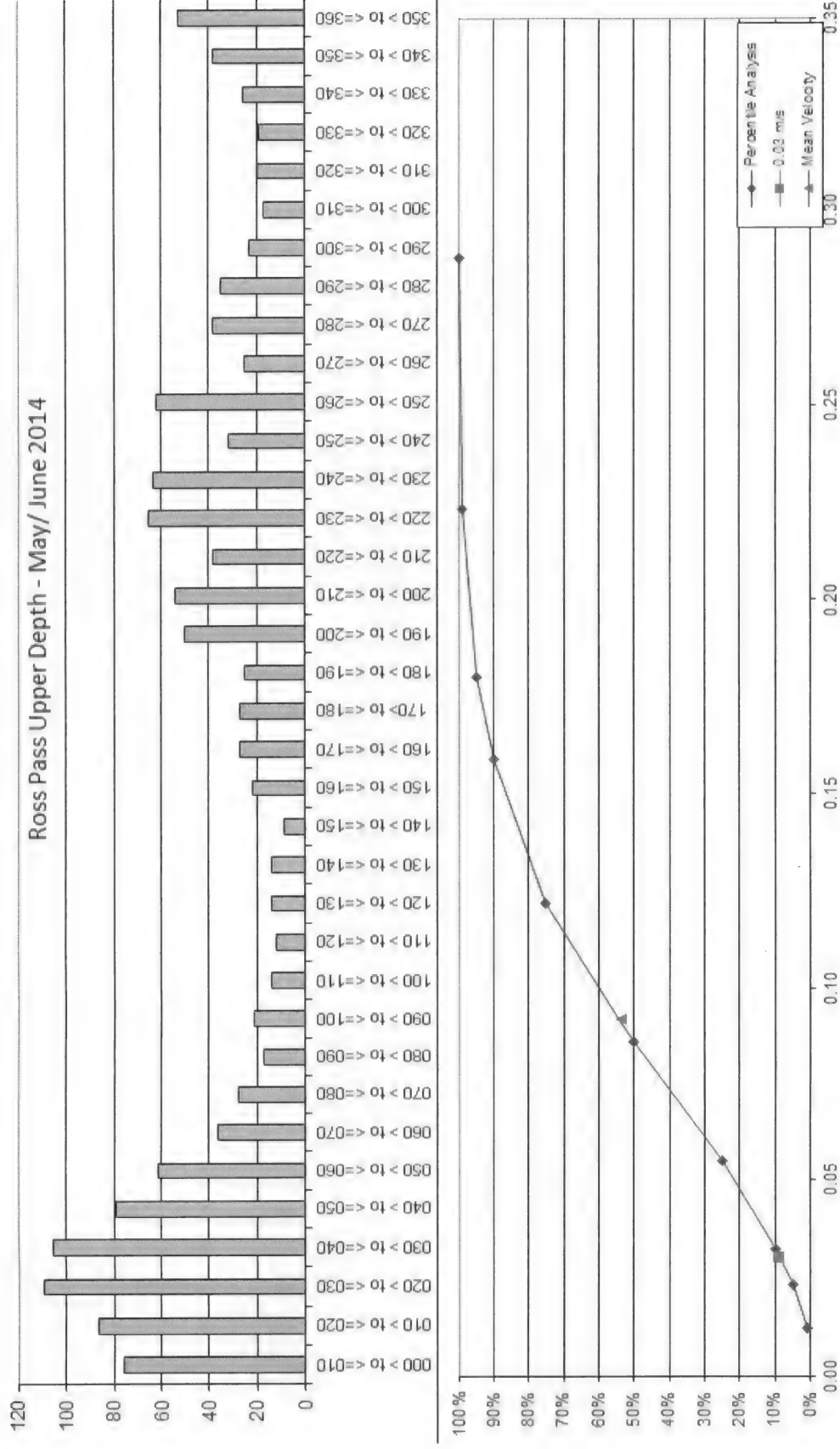


Figure 9. Frequency analysis plots of current direction and speed for the upper depth.

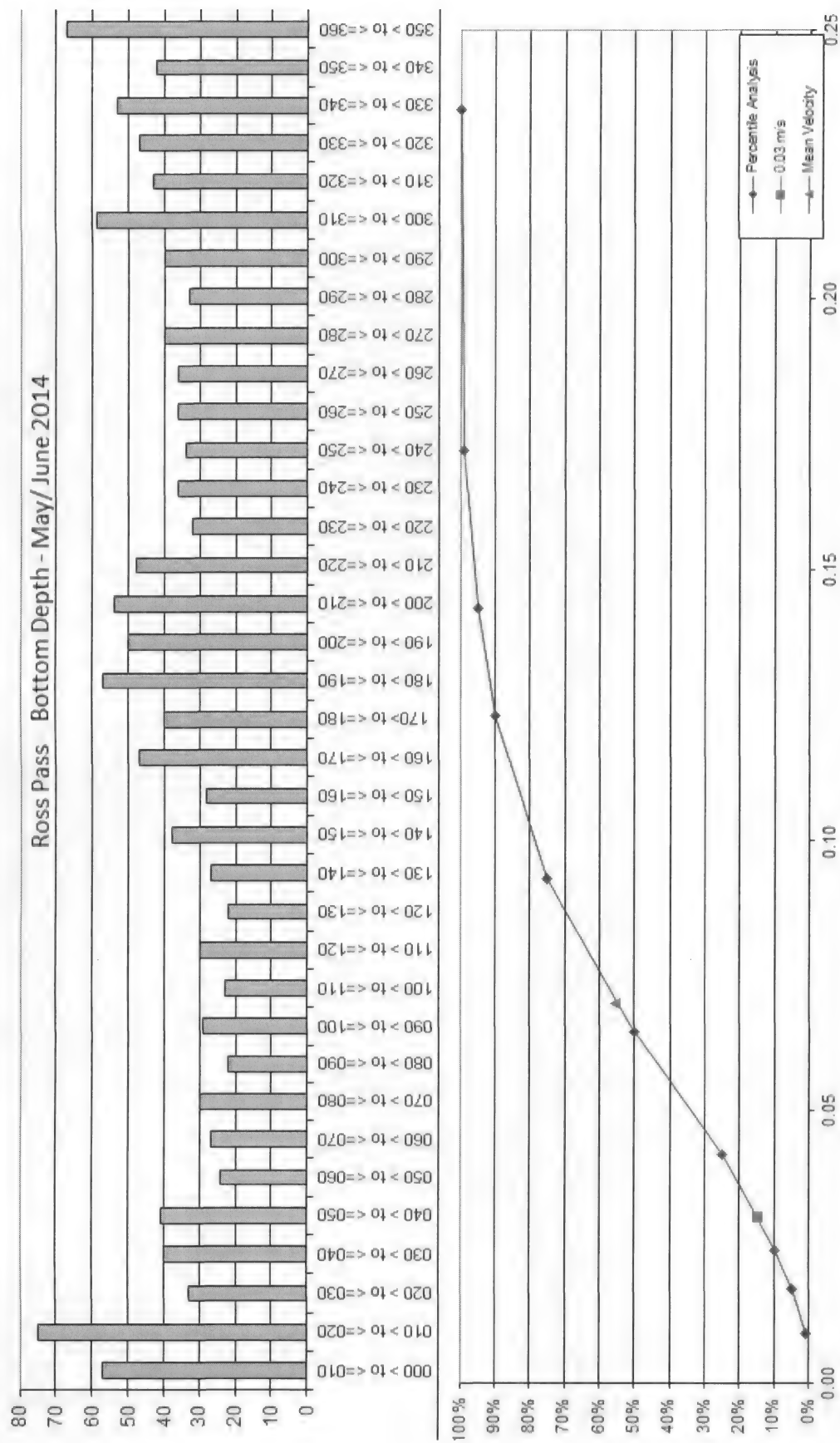


Figure 10. Frequency analysis plots of current direction and speed for the lower depth.

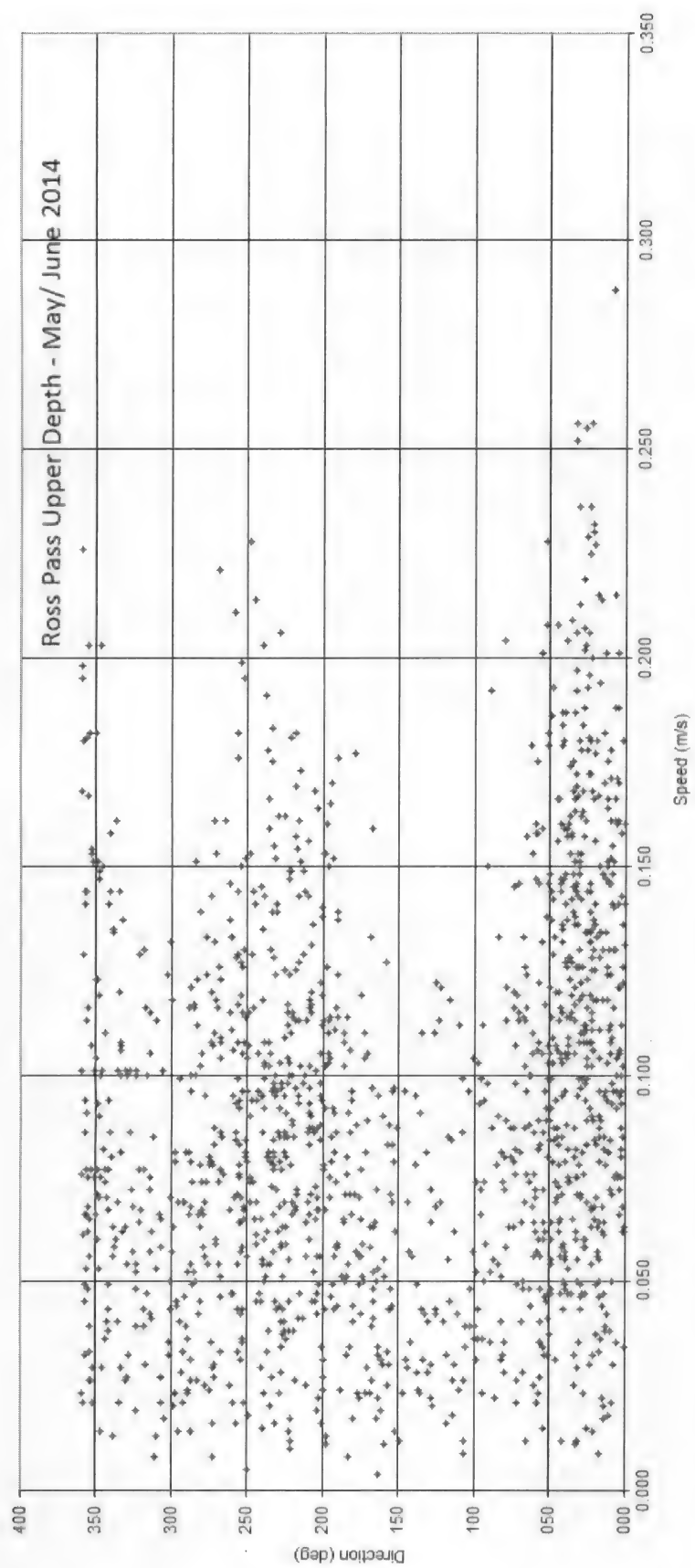


Figure 11. Speed versus direction plots for the upper depth.

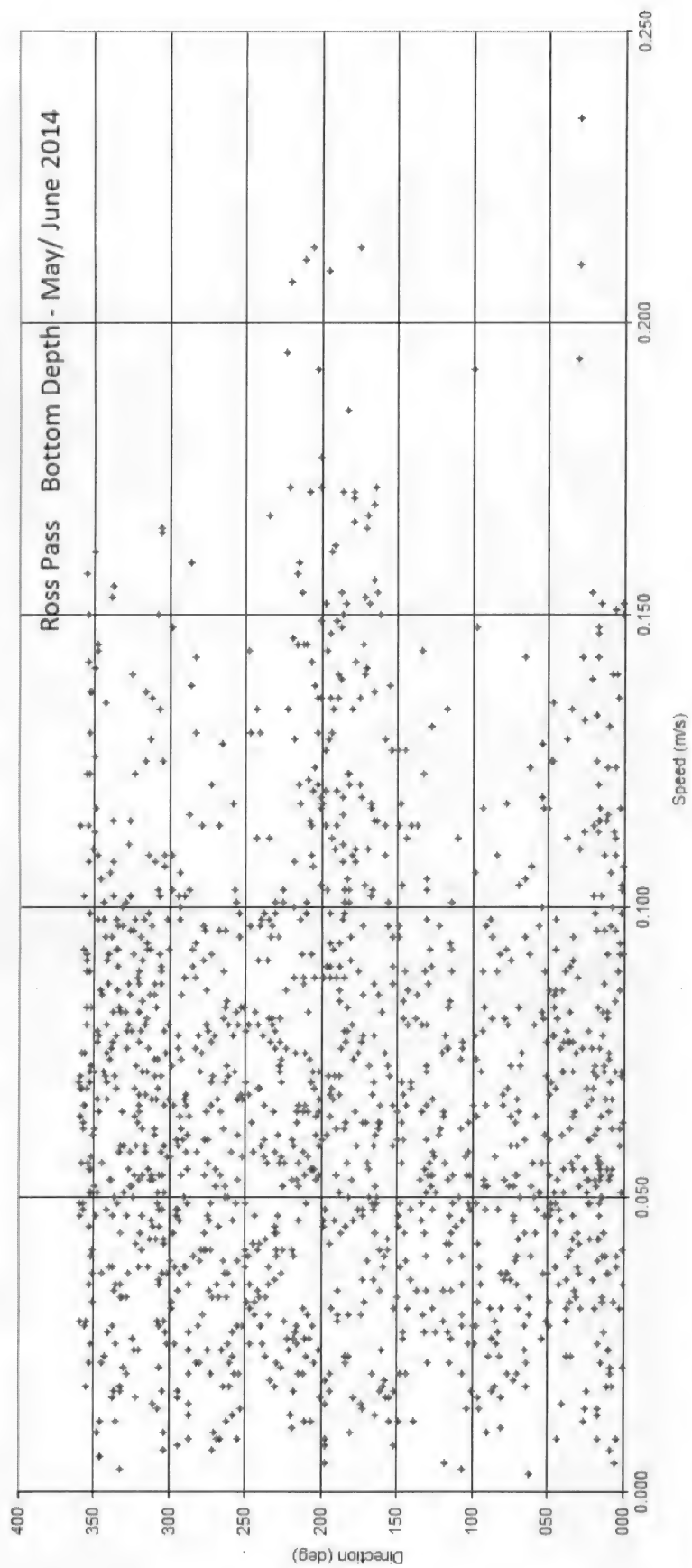


Figure 12. Speed versus direction plot for bottom depth.

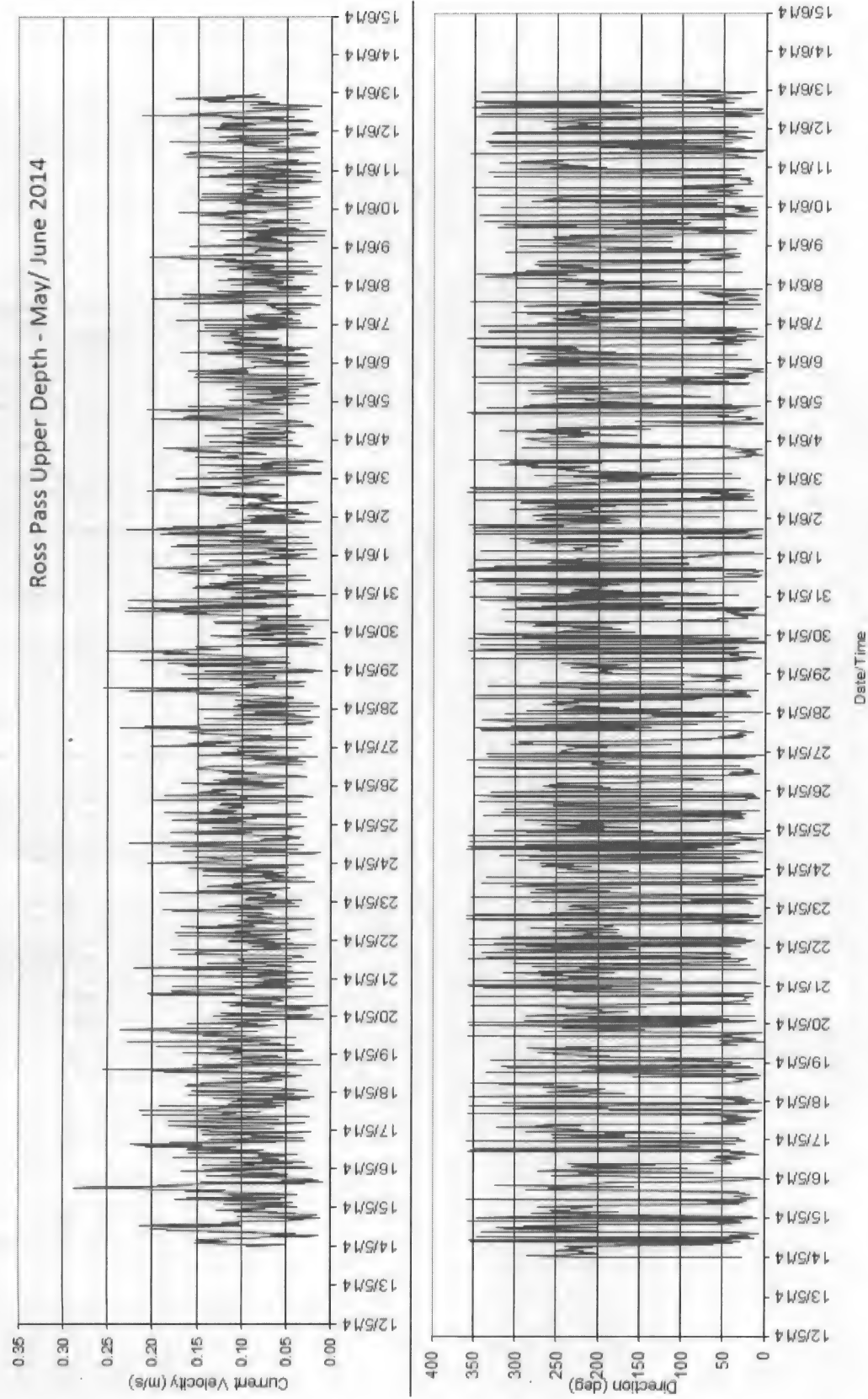


Figure 13. Time series plots of current speed and direction for the upper depth.

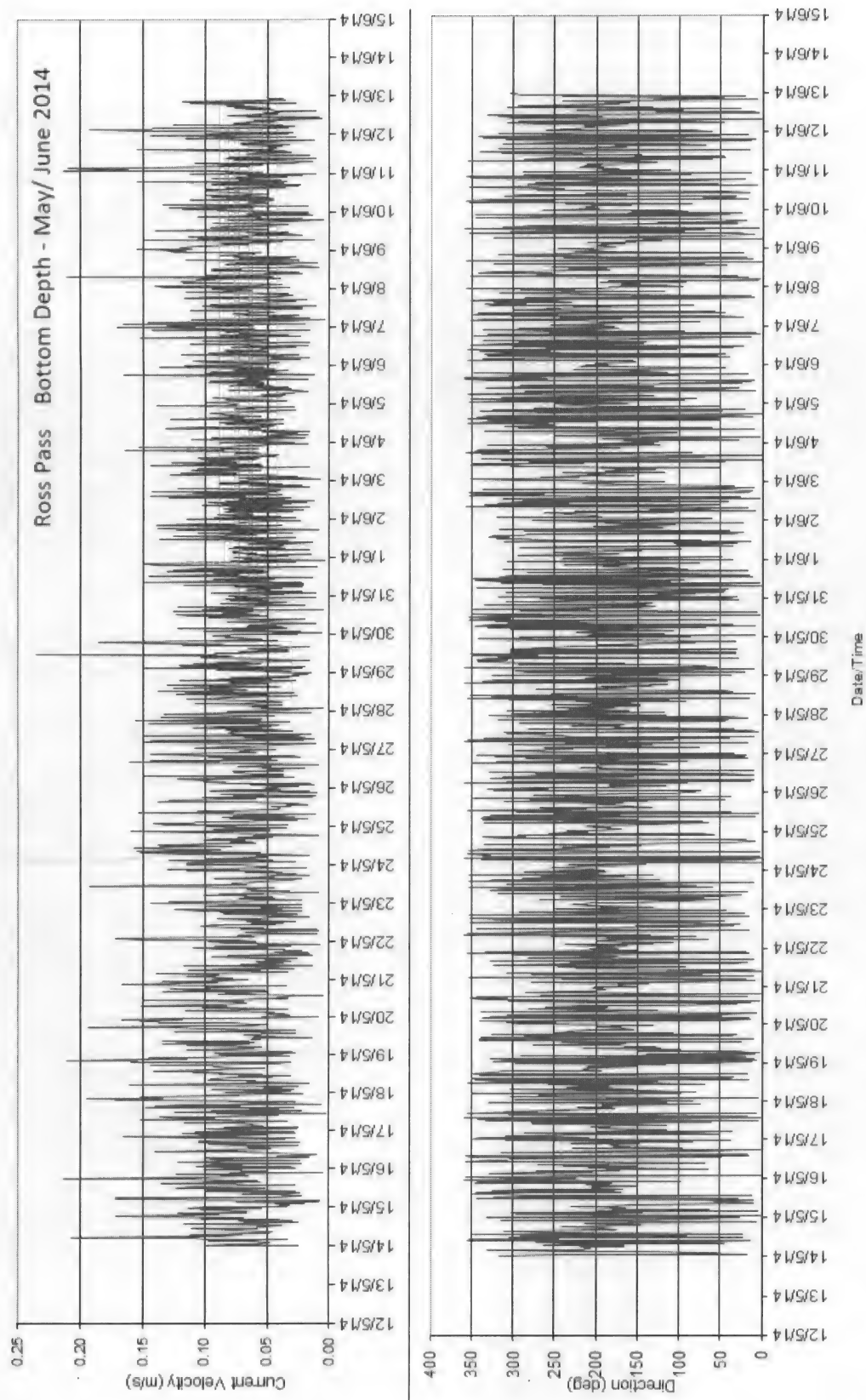


Figure 14. Time series plots of current speed and direction for the bottom depth.

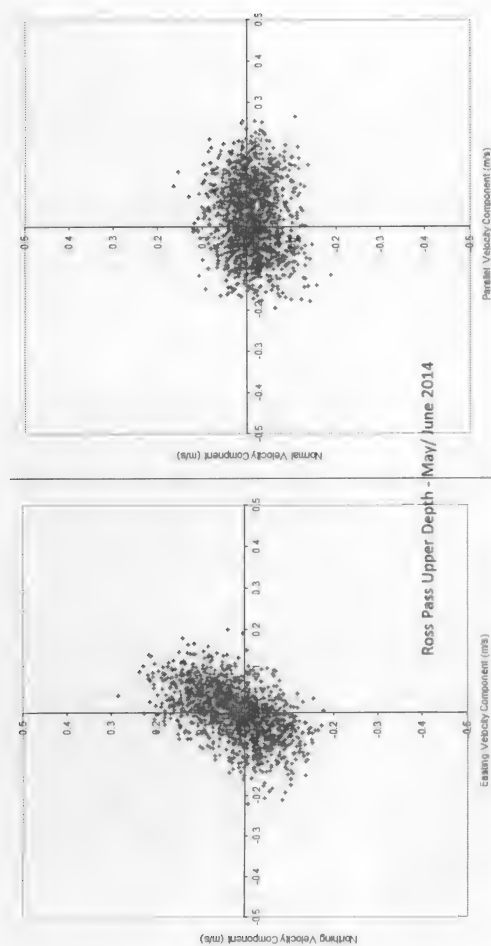


Figure 15. Scatter plots of current speed and directions for the upper depth.

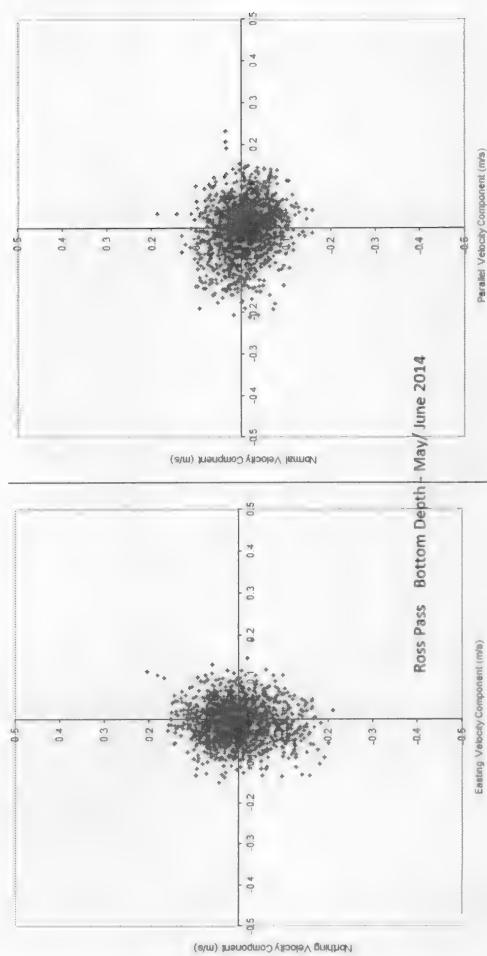


Figure 16. Scatter plots of current speed and directions for the bottom depth.

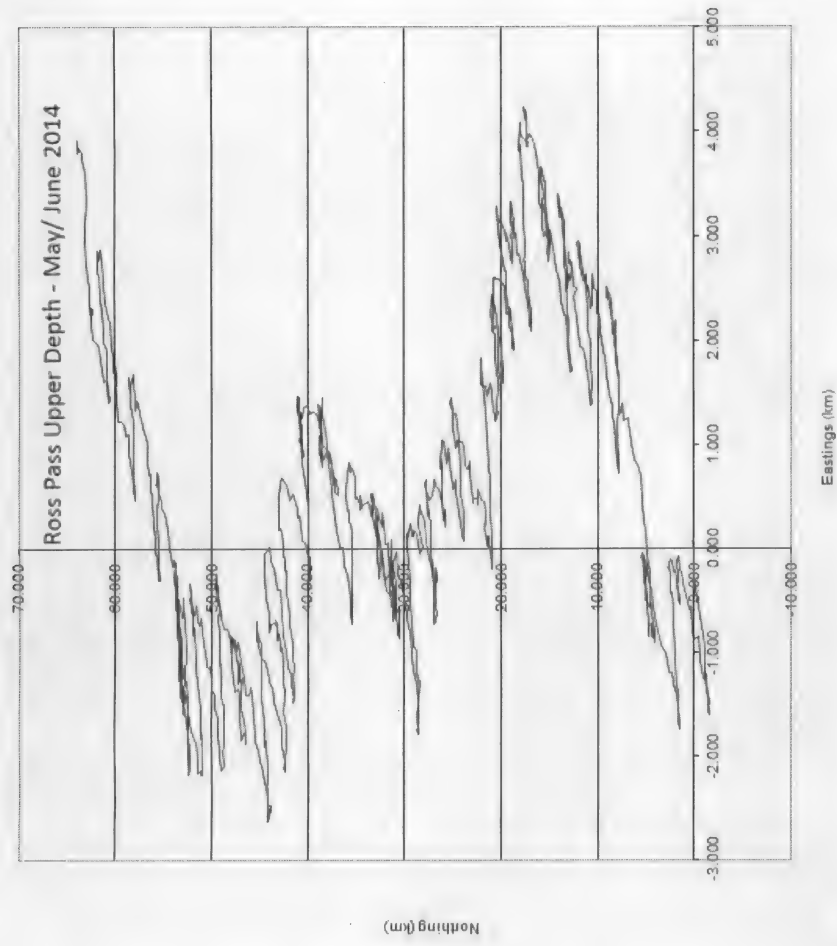


Figure 17. Cumulative vector plot for upper depth.

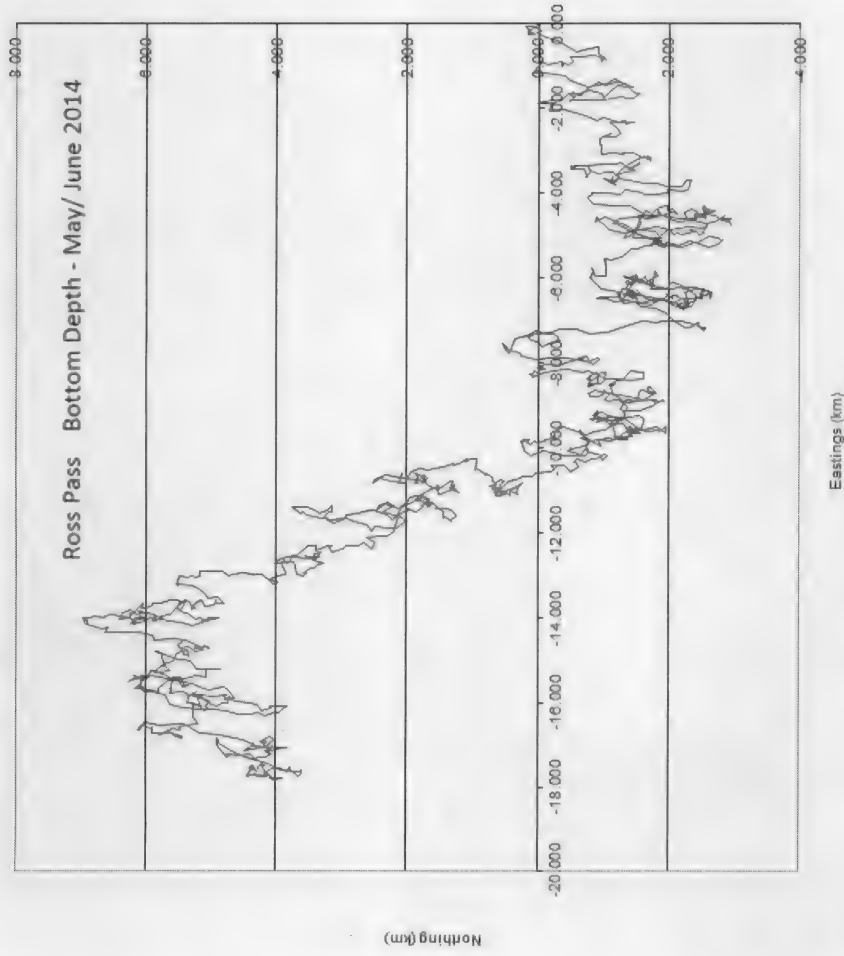


Figure 18. Cumulative vector plot for lower depth.

Contact re. deployment: [redacted] Ocean Dynamics [redacted]
Contact regarding model simulations: [redacted] of IEC at [redacted]

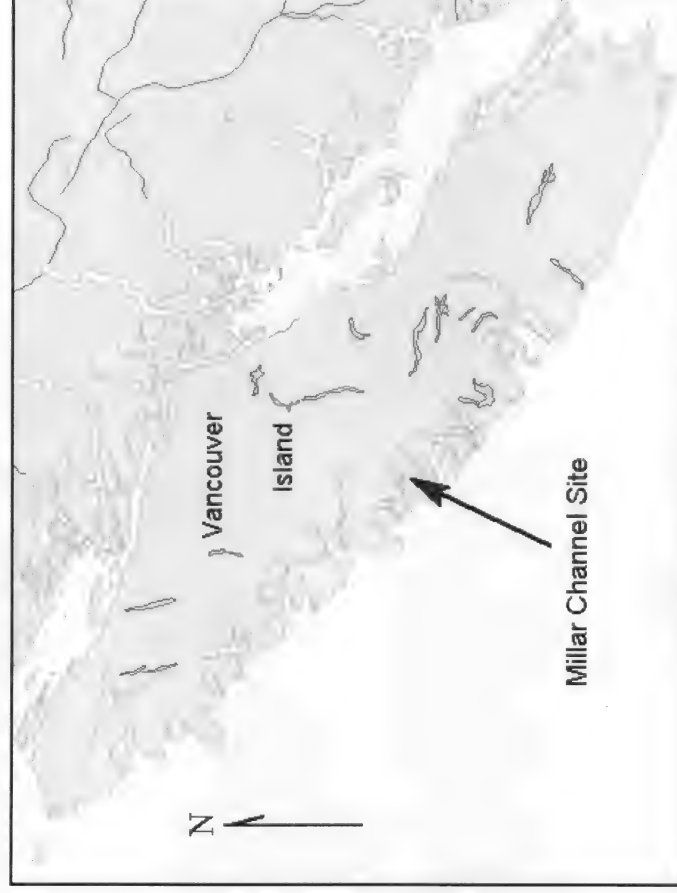
- Also contained in appended file: Ross Pass DEPOMOD 2x5 Sept2014.zip
- Raw current data
 - DEPOMOD files used in Grid generation, Particle tracking, and Resuspension modules
 - Associated shp files for pens and site boundaries.

References:

Cromey, C. J., T. D. Thomas and K. D. Black 2002a. DEPOMOD- modelling the deposition and biological effects of waste solids from marine cage farms. *Aquac.* 214, 211-239.

Cromey, C. J., T. D. Nickell, K. D. Black, P. G. Provost and C. R. Griffiths 2002b. Validation of Fish Farm Waste Resuspension Model by Use of a Particulate Tracer Discharge from a Point Source in a Coastal Environment. *Estu.* Vol. 25, No. 5, 916-929.

DEPOMOD Documentation for
Mainstream Canada Millar Channel Site
Clayoquot Sound
2 x 6 Pen Configuration
(30 x 30 x 15 meter pens)



November 12, 2012

1.0 DEPOMOD prediction of waste distribution

DEPOMOD (DEPOMOD v 2.2 Jan. 2001:) was used to predict the distribution of wastes at the Millar Channel site (2x6 pen configuration; Figure 1) for Mainstream Canada.

DEPOMOD is a model developed in Scotland (Cromey *et al*, 2002a) to assist in location of fish farms and in the regulatory process by predicting the waste accumulation on the seabed arising from fish farms.

DEPOMOD uses local currents, bathymetry, pen location and size and feed quantities to predict the extent of distribution or "footprint" of the farm wastes as total solids or as organic carbon calculated over a period of time or as fluxes (fluxes were predicted for the Millar Channel site for maximum and average feed). Information on the models and field validation are presented by Cromey *et al* (2002a and b).

The model consists of a series of modules or sub-models

- A grid development module with depth/ pen, etc. location
- a particle tracking model
- a resuspension/organic decay module (resuspension was not used)
- a semi-empirical benthic impact module (not used)

It has been noted that aspects requiring further investigation include application of the model at depths greater than about 70 meters and areas and/or with steep depth gradient (C. Cromey at BCARDC Workshop on Wastes, Nov. 25&26, 2003). The model is undergoing validation in BC conditions. Modeling has been undertaken by IEC to the best of our ability using supplied data and information and DEPOMOD Version 2.2. It should be noted that the results are estimates only and subject to the above conditions and limitations.

Current meters were deployed at the site and collected data September 24 to November 19, 2012. Modeling using DEPOMOD has been undertaken in November, 2012 using the first 30 days of current data and reported in the present document.

For the Millar Channel site, Table 1 presents inputs used for DEPOMOD, Figure 1 indicates the grid area used in the model and Figures 2 and 3 present the flux predictions without resuspension for the period of maximum feed input and for average feed input. Surface areas of various contour levels (grams of carbon per square meter per day) of predicted footprint based on maximum and average feeding are shown in Table 2. Mass balance calculations to determine the quantity and percent of waste material that were predicted to be deposited within the model area are included in Table 3. Hydrographic information is summarized in Section 2 below.

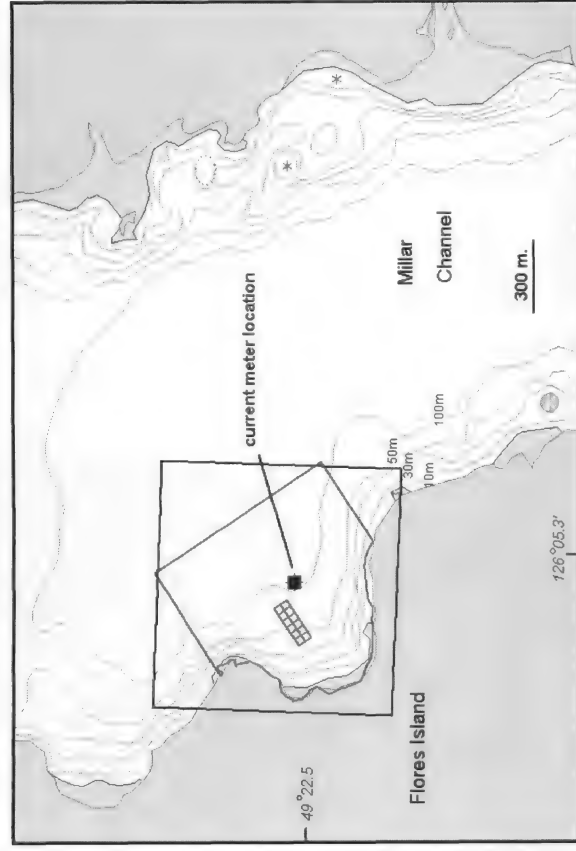


Figure 1. Diagram indicating 1000 by 1000 meter grid area used in DEPOMOD (black) at the Millar Channel site, tenure boundary (blue), pen location (blue) and current meter location.

Table 1. Site and input factors used with DEPOMOD for prediction of probable footprint at the Mainstream Canada Millar Channel site November, 2012 (**2x6; 30m pens**).

Site Name:	Miller Channel
Company:	Mainstream Canada
Location:	49 deg 22.5' 126 deg 05.5'
Land File #:	1408719
Pens	
Number and type of Cages	12 square pens
Dimensions of net cages (m)	Pen Length: - 30m Pen Width - 30m Pen Depth: - 15m
Groups of net cages and orientation	2 rows of 6 pens at 056 Deg T along length
Longitudinal spacing between cage centres (m):	32m Distance
Transverse spacing between cage centres (m):	33m
Surface area of cages (m²)	~900*12=10,800 m ²
Coordinates of first cage centre by group (UTM or lat/long):	49 deg 22.513' 126 deg 05.589'
	49 deg 22.498' 126 deg 05.574'
Feed and Grow-out	
Maximum Daily Feeding Rate (kg/day):	Feed input/pen at peak feed volume: 880kg/day @ 15 months
Average Daily Feeding Rate over the grow-out period (kg/day):	Average feed input/pen: 460 kg/day
Total feed budget for grow-out period (tonnes)	3,076 tonnes
Approx. Farm production	
Duration of grow-out period (months)	
Hydrographic:	
Current meter mooring location (UTM or lat/long):	49 deg 22.524' 126 deg 05.390' NAD83
Height of Mean Water Level above chart datum (m)	2.15 m (Riley Cove)
Depth at cage group position	45 to 95 m (from bathymetry depth)
Number of current velocity data sets used	3
Heights of mooring above sea bed	5, 56 & 96 m
Depth of water column at mooring	111 m
Length of current velocity record	30 days
Sampling interval (mins)	30 min converted to hourly with DFO-provided tool (courtesy Jon Chamberlain)
Time step of data used in model	60 min
Total number of time steps used in model	720
Mooring position	85meters at 114 degrees from the E corner of pens

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Table 1 Contd.

Bathymetry from	<p>– From bathymetry provided as 25m grid by Ocean Dynamics Canada Ltd. and Coast Spatial GIS & Mapping Specialists. (The DGPS receiver used for the bathymetric survey is a Trimble Pro XRB; sonar is a high end Lowrance X-15 with custom software supplied by Lowrance and a custom transducer capable of 2400 feet in salt water; boat speed of 1 - 2.5 meters/second yields a maximum distance of 4 to 5 meters between soundings; transects are generally 10 meters apart within the actual lease boundary and 15 meters apart outside the boundary; 2004 info; areas outside boundaries may be supplemented by CHS data as necessary)</p>
Modeling:	
Area	– x = 1000m; y = 1000m
Grid Origin	– 710709E 5472838 UTM9 NAD83
Major Grid/ Minor Grid sizes	– 25x25m/ 10x10m
Food water content	– 10%
Digestibility of feed	– 90%
% Carbon in feed	– 57%
% Carbon in faeces	– 33%
Food wasted as % of food fed	– 3%
Food particle settling velocity distribution	– 11.0cm/s
Faecal particle settling velocity distribution	– 3.2cm/s SD 1.1 cm/s
Turbulence Model	– Random Walk
Horizontal dispersion coefficients	– 0.1 m ² /s
Vertical dispersion coefficient	– 0.001 m ² /s
Trajectory evaluation accuracy	– High 60s
Number of particles used	– 10
Resuspension Model/ Options	– OFF
Other Models	– Not used
Output	– Flux (grams C/m ² /year; calc. to /day)

Contact regarding model simulations

– IEC

s.19(1)

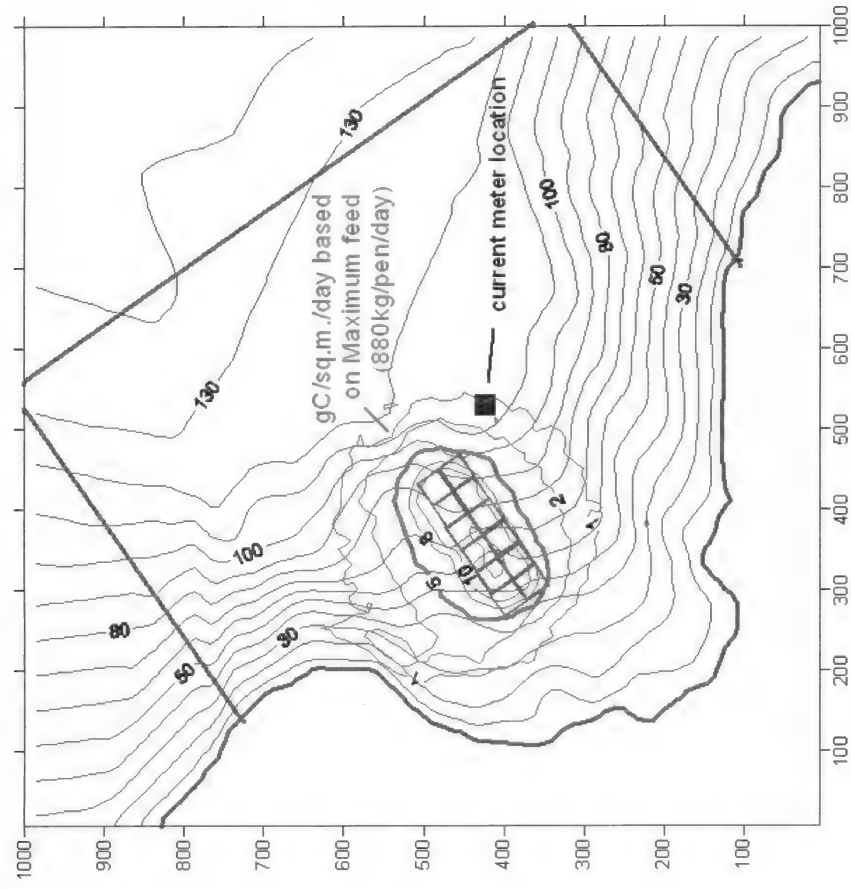
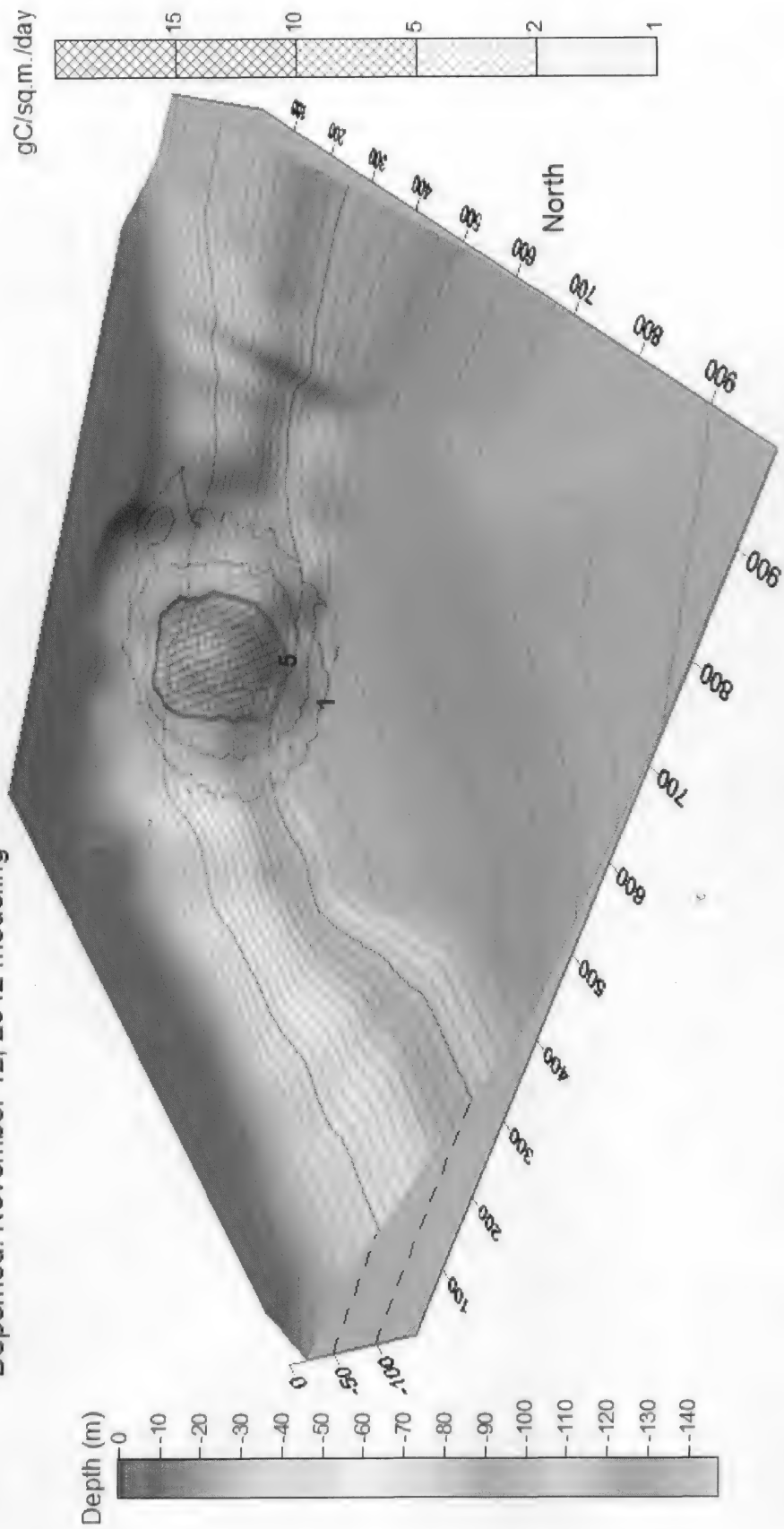


Figure 2. DEPOMOD predicted footprint contours based on maximum feeding. Pen centers are boxes; heavy blue lines are boundaries. Blue contour lines are depths in meters.

Millar - 2 x 6 array of 30m cages
Based on Maximum Feed (880 kg/pen/day)
Depomod: November 12, 2012 modeling



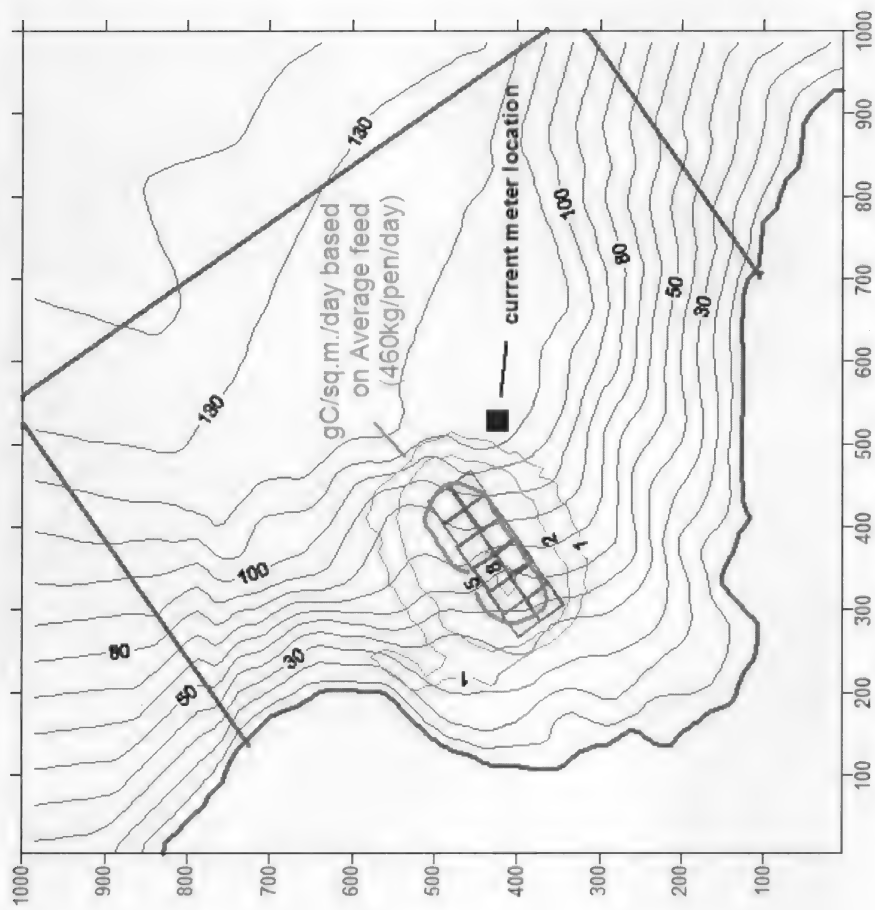


Figure 3. DEPOMOD predicted footprint contours based on average feeding. Pen centers are boxes; heavy blue lines are boundaries. Blue contour lines are depths in meters.

Millar - 2 x 6 array of 30m cages
Based on Average Feed (460 kg/pen/day)
Depomod: November 12, 2012 modeling

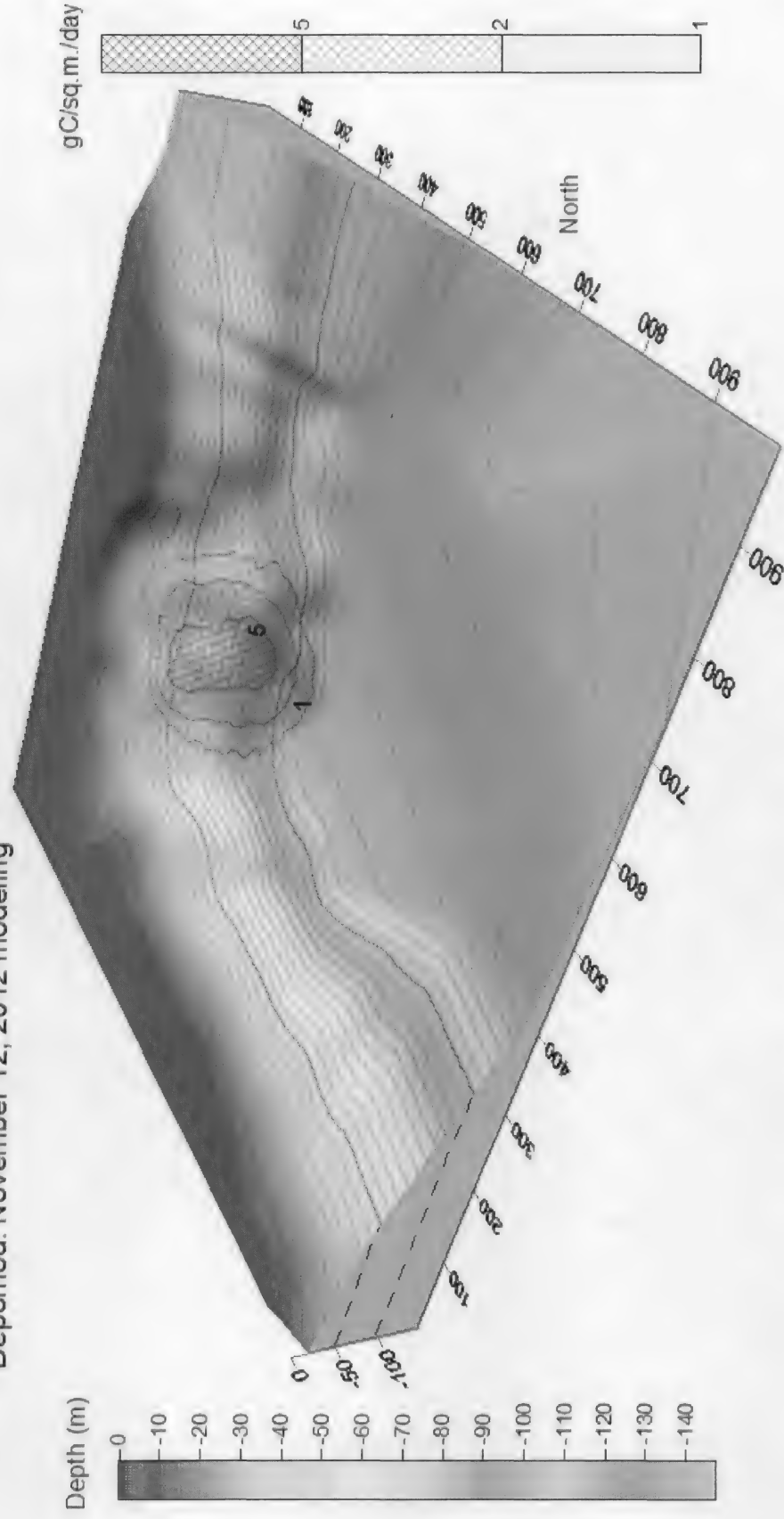


Table 2. Surface area of predicted footprints contours based on maximum (above) and average (lower) feeding

Maximum Feed gC/sq.m./day	No Resuspension	
	Surfer	Positive Planar Area [cut] (sq.m.)
1	89,842	
2	55,356	
5	28,038	
8	17,178	
10	12,058	
15	954	
20	0	

Average Feed gC/sq.m./day	No Resuspension	
	Surfer	Positive Planar Area [cut] (sq.m.)
1	57,247	
2	34,388	
5	13,183	
8	587	
10	0	

Table 3. Mass balance calculations for the Millar Channel site to determine the quantity and percent of material deposited within the model area based on maximum (upper) and average (lower) feeding. (method used as in DCPI50 - DFO Marine Fish Habitat Information Requirements for Finfish Aquaculture Projects).

Maximum feed		No Resuspension	
Surfer	Volume [cut] value/day in grid area	Surfer	Volume [cut] value/day in grid area
			465,984 g C
feed per pen/day/pen (kg) or total feed, all pens X feed X 0.044 (C calc. as in method)	# pens	12	
	feed per pen/day/pen (kg)	880 kg	
	or	880,000 g	
	total feed, all pens	10,560,000 g	
	X	0.044	
	feed X 0.044 (C calc. as in method)	464,640 g C	
C deposited in grid area as % of expected from feed		100.3%	
Average feed			
Surfer	Volume [cut] value/day in grid area	No Resuspension	Volume [cut] value/day in grid area
			243,583 g C
feed per pen/day/pen (kg) or total feed, all pens X feed X 0.044 (C calc. as in method)	# pens	12	
	feed per pen/day/pen (kg)	460 kg	
	or	460,000 g	
	total feed, all pens	5,520,000 g	
	X	0.044	
	feed X 0.044 (C calc. as in method)	242,880 g C	
C deposited in grid area as % of expected from feed		100.3%	

2.0 Hydrographic Data

Information about the current meters and their location and deployment is presented in Table 4.

Table 4. Current meter deployment information.

<u>Equipment</u>	
Meter(s):	<ul style="list-style-type: none"> - Nortek Aquadopp Current Profiler: Aquapro 400kHz (see Figure 4 for specification sheet) - Serial Number: AQD5108/ AQD5115 - Last calibration and servicing – n/a
<u>Current Meter Deployment</u>	
Meter location:	<ul style="list-style-type: none"> - Mainstream Canada Millar Channel site at a location 85meters at 114 degrees from the E=most corner of pens - 49 deg 22.524' 126 deg 05.390' NAD83; see Figure 5). - For the site, Magnetic North = 17.8 degrees True
Magnetic declination	
Depth at location:	- 111 meters
Tidal range:	- 4.37 meters based on Riley Cove current station
Mean Water Level:	- 2.15 meters
Meter recording	- surface (15meter depth)
Depths:	<ul style="list-style-type: none"> - midwater (56m; at mid water depth for site greater than 50 meters in depth); and - near-bottom (5 meters above the sea floor at 96 meters depth)
Record type:	<ul style="list-style-type: none"> - sample curr nt speed and direction at 30-minute intervals over 30 days - vector averaging
Averaging period:	- 2 minutes
Mooring:	- see figure 6 for description
Start:	- 00:00 PDT (UTC-7) September 24, 2011 (as used in Depomod)
End:	- 23:30 PDT (UTC-7) October 23, 2011 (as used in Depomod)
Number of data points:	- 1,440
Deployed by:	- Ocean Dynamics Canada Ltd.

Data Analysis

The data is normally reviewed using Textpad program and data collected before deployment and/or after retrieval is deleted for use. Pre and post-retrieval data is determined from field records and is normally also evident in sharply increased or decreased (depending on surface air temperature) temperature readings and/or in conjunction with similarly changed axis tilt readings, etc. Data is further evaluated for any evident problems. If the data appears satisfactory, Magnetic current direction data is converted to True based on variation from Geomagnetism Magnetic declination calculator (<http://geomag.nrcan.gc.ca/apps/mdcal-eng.php>) using an Excel program created by IEC for the purpose (for the site, Magnetic North = 17.8 degrees True). Analysis took place on the 30 days of data collected at 30 minute intervals (averages over 2 minute period every 30 minutes). An Excel file was used to produce and output the current speed/ direction array. The array is copied to an Excel file that uses the data to provide tabular and graphic summaries of the current speed and direction for the data.

Results are presented in Tables 5 to 8 and Figures 5 and 7 to 24. A toolkit provided by DFO (courtesy of Jon Chamberlain) at a July/04 DEPOMOD workshop to aid in the visual analysis of hydrographic data has been used to prepare Figures 10 to 24 for review.

Table 5. Average current speed and direction for the 30 day period including 1440 records. Note that average direction does not indicate dominant direction(s) in all cases.

Average direction (Deg T)	Depth		
	Top	Middle	Bottom
	345.3	48.5	18.6
Speed cm/s	Max		
	Min		
	Average		
	140.4	15.3	21.3
	0.1	0.1	0.0
	10.1	5.3	5.3
%			
of time > 5cm/s	79%	49%	50%

Currents at the site were found to be in general slower at the mid-depth and lower depth. The upper depth had a few events where currents were more rapid (see Figure 19). Current directions recorded at the upper depth indicated some trend northwest and southeast approximately along shore. The mid-depth and lower depths showed very variable directions. Profiler data suggests that currents recorded in the upper 30 meters of the water column were somewhat directional while the currents below were more variable. The current vector plot for the lower depth appears unusual (Figure 24).

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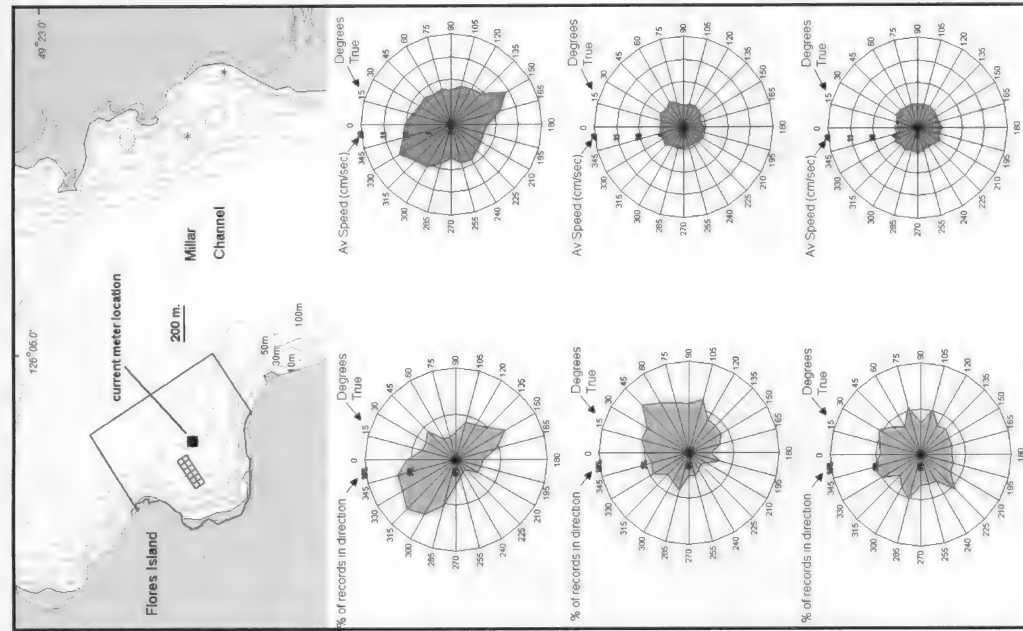
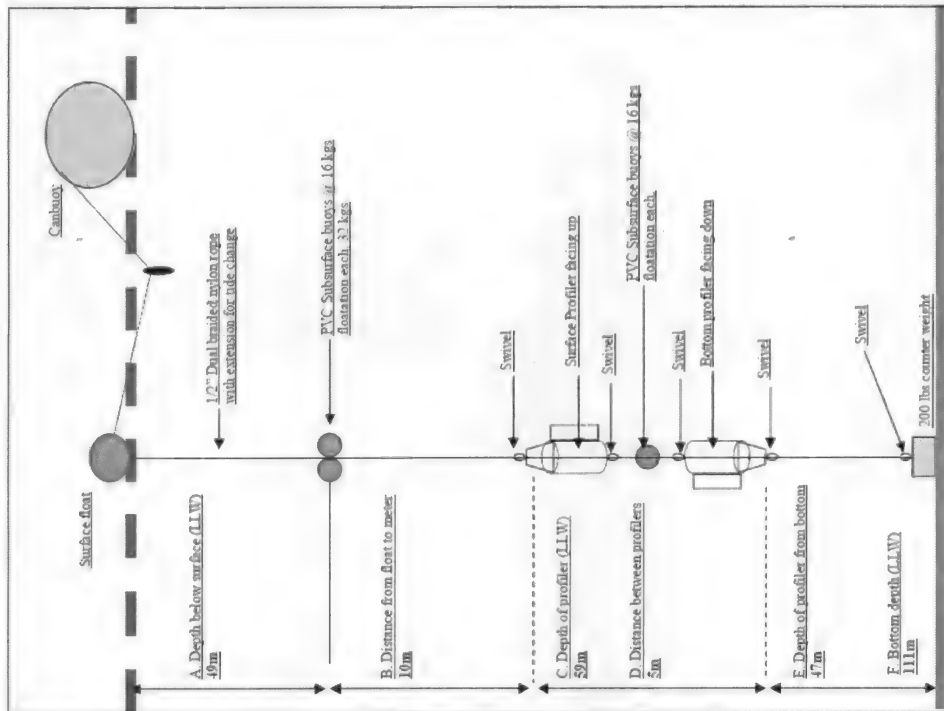


Figure 5. Diagram indicating relation of current measurements at the Millar Channel site for the Sept. 24 to Oct. 23, 2011 period. Average speed recorded and the percent of records in each direction (in which current flows) category are shown for the upper, middle and lower meters. The site diagram has been aligned with true north at the top of the page as shown in the current graphs.

Company Completing Assessment: Ocean Dynamics Canada Ltd.
Current Meter Manufacturer and Model: Aquadopp Current Profiler



Serial Number: AQD 5108 & 5115

Last calibration date:

Last Service date:

Deployment Date: 09/24/2011 Time: 12:00:00 AM

MM/DD/YYYY

PST

Recovery Date: 11/19/2011 Time: 11:30:00 AM

MM/DD/YYYY

PST

Mooring Location:

NAD-27

Latitude: 49 22 524

NAD-83

Longitude: 126 05 390

Sampling Interval:

Instantaneous:

2 Minutes

Averaging:

120 Samples

Subsurface Floatation:

Description:

Three 16kg hard floats

Floatation:

48 kg

Anchor:

Description:

Five 18kg Cannon Balls

Weight:

90 kg

Mooring Materials Description

Location of swivels:

indicated on diagram

Type of line:

1/2\" dual braided nylon

Method of recovery:

Lift from surface float

other:

Note:

if meter(s) were deployed in a way other than that of a standard sub-surface mooring, please provide an appropriate description of materials and configuration of the meter(s).

Figure 6. Diagram indicating anchoring and setup of current meters at site. Diagram courtesy of Ocean Dynamics. Data collected at 5, 56 and 96m above bottom.

Table 6. Breakdown of sampled current data for the upper depth suspended at 15 meter depth at the Millar Channel site for Sept. 24 to Oct. 23, 2011. Samples were taken every 30 minutes; each sample represents the average over a 2 minute period. The number of samples with speed and direction within ranges centered at the indicated numbers are shown.

Mooring Site: Millar Channel		Time(24h): Date(DMY) Sample# (PST)												
Position: Top	Start: 0:00	24-Sep-11	1											
Deployment Location: DGPS:	Final: 23:30	23-Oct-11	1440											
Latitude: 49 deg 22.524'	Total # of Samples: 1440													
Longitude: 126 deg 05.390'														
Datum: NAD83														
Description: Millar Channel Site, Millar Channel, off east side Flores Island														
Station Depth: 15 Meters														
Bottom/ anchor depth: 111 Meters														
Instrument: make: Nortek Aquadopp														
model: Aquaprop														
serial #: 51085115														
Meter Calibration: n/a														
Records in : Degrees True (Mag. North = 17.8 deg. True)														
Sample Interval: 30 Minutes														
Total # Measurements: 1440 (Sample is 2 minute average)														
Contact re. deployment: Ocean Dynamics														
Contact re. Reporting: IEC														
Direction Deg True	Speed (cm/sec)	0	3	5	7	10	15	20	30	50	100	150	200	sum %
0	0	8	11	11	11	23	18	6	1	0	0	0	0	5.4%
15	0	8	12	10	12	12	11	3	0	0	0	0	0	3.9%
30	1	13	7	11	13	6	4	0	0	0	0	0	0	3.8%
45	3	8	7	16	18	10	1	0	0	0	0	0	0	4.4%
60	3	5	6	9	8	5	1	0	0	0	0	0	0	2.6%
75	1	4	4	11	11	5	0	0	0	0	0	0	0	2.5%
90	1	5	9	11	16	1	1	0	0	0	0	0	0	3.1%
105	2	11	8	15	9	12	5	0	0	0	0	0	0	4.3%
120	2	7	11	13	15	12	2	1	0	0	0	0	0	4.4%
135	0	13	9	8	21	14	7	0	0	0	0	0	0	5.0%
150	0	12	10	19	20	15	7	3	3	1	1	0	0	6.3%
165	1	10	8	11	11	17	3	4	1	0	0	0	0	4.6%
180	0	6	9	14	8	2	4	0	0	0	0	0	0	3.0%
195	4	8	7	4	11	5	2	0	0	0	0	0	0	2.8%
210	3	8	9	5	10	4	1	1	0	0	0	0	0	2.8%
225	0	2	7	5	5	6	2	1	0	0	0	0	0	1.6%
240	0	5	3	4	7	2	1	1	0	0	0	0	0	1.6%
255	0	6	3	6	7	6	1	0	0	0	0	0	0	2.0%
270	0	6	10	9	12	3	0	0	0	0	0	0	0	2.8%
285	4	9	10	15	19	12	6	0	0	0	0	0	0	5.2%
300	1	5	16	17	26	18	15	1	0	0	0	0	0	6.9%
315	3	8	16	20	23	22	13	4	1	0	0	0	0	7.6%
330	0	7	10	12	24	24	15	3	3	0	0	0	0	6.8%
345	1	11	10	13	24	21	13	2	0	0	0	0	0	6.6%
sum %:	2.1%	12.8%	14.7%	18.7%	24.6%	17.2%	7.8%	1.5%	0.6%	0.1%	0.1%	0.0%	0.0%	

s.19(1)

Table 7. Breakdown of sampled current data for the middle depth suspended at 55 meter depth at the Millar Channel site for Sept. 24 to Oct. 23, 2011. Samples were taken every 30 minutes; each sample represents the average over a 2 minute period. The number of samples with speed and direction within ranges centered at the indicated numbers are shown.

Mooring Site: Millar Channel		Time(24h) Date(DMY) Sample# (PST)																
Position: Mid-depth	Start: 0:00	24-Sep-11	1															
Deployment Location:	Final: 23:30	23-Oct-11	1440															
DGPS:	Latitude: 49 deg 22.524'	Total # of Samples:	1440															
	Longitude: 126 deg 05.390'																	
	Datum: NAD83																	
Description: Millar Channel Site, Millar Channel, off east side Flores Island																		
Station Depth:	55 Meters																	
Bottom/ anchor depth:	111 Meters																	
Instrument: make: Nortek Aquadopp																		
model: Aquaprop																		
serial #: 5108/5115																		
Meter Calibration: n/a																		
Records in : Degrees True (Mag. North = 17.8 deg. True)																		
Sample Interval: 30 Minutes																		
Total # Measurements: 1440 (Sample is 2 minute average)																		
Contact re. deployment: Ocean Dynamics																		
Contact re. Reporting: IEC																		
Direction	Speed (cm/sec)																	sum %
Deg True	0	5	17	21	7	10	15	20	30	50	100	150	200					
0	5	17	21	17	9	0	0	0	0	0	0	0	0	0	0	0	0	4.8%
15	7	19	24	18	10	1	0	0	0	0	0	0	0	0	0	0	0	5.5%
30	2	19	22	16	17	2	0	0	0	0	0	0	0	0	0	0	0	5.4%
45	6	25	27	35	12	2	0	0	0	0	0	0	0	0	0	0	0	7.4%
60	0	23	30	13	19	6	0	0	0	0	0	0	0	0	0	0	0	6.3%
75	5	25	26	14	7	4	0	0	0	0	0	0	0	0	0	0	0	5.6%
90	5	32	18	14	9	0	0	0	0	0	0	0	0	0	0	0	0	5.4%
105	6	23	28	19	9	1	0	0	0	0	0	0	0	0	0	0	0	6.0%
120	1	21	22	9	7	1	0	0	0	0	0	0	0	0	0	0	0	4.2%
135	4	20	13	19	5	0	0	0	0	0	0	0	0	0	0	0	0	4.2%
150	8	21	18	8	4	0	0	0	0	0	0	0	0	0	0	0	0	4.1%
165	6	19	18	7	1	0	0	0	0	0	0	0	0	0	0	0	0	3.5%
180	2	14	9	7	3	0	0	0	0	0	0	0	0	0	0	0	0	2.4%
195	4	19	15	12	1	0	0	0	0	0	0	0	0	0	0	0	0	3.5%
210	1	10	10	8	2	0	0	0	0	0	0	0	0	0	0	0	0	2.2%
225	4	9	5	5	3	0	0	0	0	0	0	0	0	0	0	0	0	1.8%
240	6	9	8	5	3	0	0	0	0	0	0	0	0	0	0	0	0	2.2%
255	4	12	12	9	1	0	0	0	0	0	0	0	0	0	0	0	0	2.6%
270	1	19	7	5	4	0	0	0	0	0	0	0	0	0	0	0	0	2.5%
285	9	17	17	10	9	0	0	0	0	0	0	0	0	0	0	0	0	4.3%
300	5	19	13	9	5	1	0	0	0	0	0	0	0	0	0	0	0	3.6%
315	5	9	11	14	6	2	0	0	0	0	0	0	0	0	0	0	0	3.3%
330	6	18	18	19	6	1	0	0	0	0	0	0	0	0	0	0	0	4.7%
345	5	16	15	17	9	0	0	0	0	0	0	0	0	0	0	0	0	4.3%
sum %:	7.4%	30.2%	28.3%	21.5%	11.2%	1.5%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%

s.19(1)

Table 8. Breakdown of sampled current data for the lower depth suspended at 106 meter depth at the Millar Channel site for Sept. 24 to Oct. 23, 2011. Samples were taken every 30 minutes; each sample represents the average over a 2 minute period. The number of samples with speed and direction within ranges centered at the indicated numbers are shown.

Mooring Site: Millar Channel															Time(24h)	Date(DMY)	Sample#	(PST)	
Position: Bottom															Start:	0:00	24-Sep-11	1	
Deployment Location:															Final:	23:30	23-Oct-11	1440	
DGPS:															Total # of Samples: 1440				
Latitude: 49 deg 22.524'																			
Longitude: 126 deg 05.390'																			
Datum: NAD83																			
Description: Millar Channel Site, Millar Channel, off east side Flores Island																			
Station Depth: 106 Meters																			
Bottom/ anchor depth: 111 Meters																			
Instrument: make: Nortek Aquadopp																			
model: Aquaprop																			
serial #: 5108/5115															Meter Calibration: n/a				
Records in : Degrees True															(Mag. North = 17.8 deg. True)				
Sample Interval: 30 Minutes																			
Total # Measurements: 1440 (Sample is 2 minute average)																			
Contact re. deployment: Ocean Dynamics															Contact re. Reporting: IEC				
Direction	Speed (cm/sec)	0	3	5	7	10	15	20	30	50	100	150	200	sum %					
Deg True	0	5	21	14	14	8	2	0	0	0	0	0	0	4.4%					
15	10	26	12	12	7	1	0	0	0	0	0	0	0	4.7%					
30	3	20	22	18	10	3	0	0	0	0	0	0	0	5.3%					
45	3	18	14	20	7	0	0	0	0	0	0	0	0	4.3%					
60	3	16	15	10	4	2	0	0	0	0	0	0	0	3.5%					
75	5	20	24	17	10	2	0	0	0	0	0	0	0	5.4%					
90	2	16	13	14	4	1	0	0	0	0	0	0	0	3.5%					
105	7	21	14	21	7	2	1	0	0	0	0	0	0	5.1%					
120	5	10	16	15	4	2	0	0	0	0	0	0	0	3.6%					
135	5	19	13	12	5	1	1	0	0	0	0	0	0	3.9%					
150	7	10	19	10	6	0	0	0	0	0	0	0	0	3.6%					
165	3	14	18	13	3	0	0	0	0	0	0	0	0	3.5%					
180	1	21	10	9	7	2	0	0	0	0	0	0	0	3.5%					
195	6	15	12	14	6	0	0	0	0	0	0	0	0	3.7%					
210	3	15	13	18	4	2	0	0	0	0	0	0	0	3.8%					
225	5	30	17	16	6	2	0	0	0	0	0	0	0	5.3%					
240	5	18	14	8	3	0	0	0	0	0	0	0	0	3.3%					
255	3	19	8	12	7	0	0	0	0	0	0	0	0	3.4%					
270	1	15	13	12	7	1	0	0	0	0	0	0	0	3.4%					
285	2	27	18	18	7	0	0	0	0	0	0	0	0	5.0%					
300	3	16	18	15	6	2	0	0	0	0	0	0	0	4.2%					
315	1	12	17	14	2	0	0	0	0	0	0	0	0	3.2%					
330	2	19	18	17	13	2	0	0	0	0	0	0	0	4.9%					
345	5	33	22	11	6	2	0	0	0	0	0	0	0	5.5%					
sum %:	6.6%	31.3%	26.0%	23.6%	10.3%	2.0%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%						

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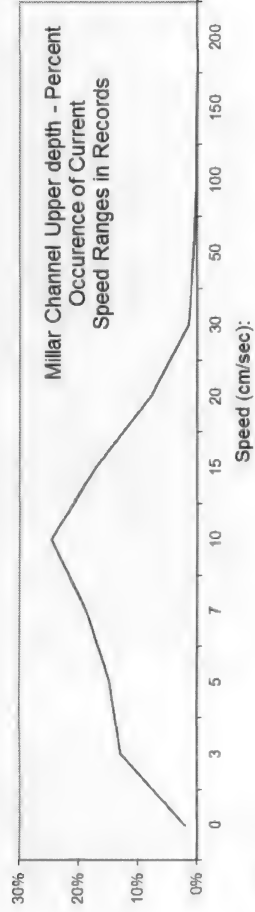


Figure 7. Percent occurrence of current speed for the upper depth 15 meters depth at the Millar Channel site for Sept. 24 to Oct. 23, 2011.

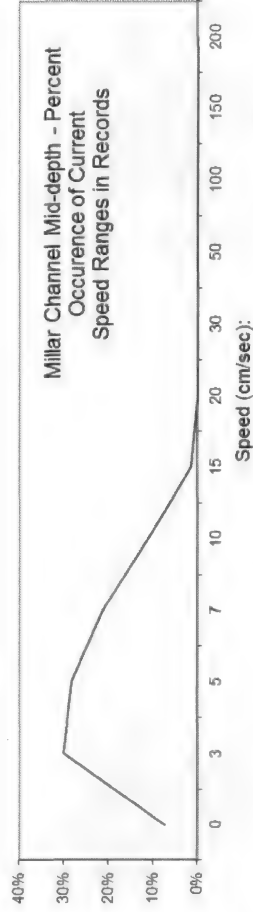


Figure 8. Percent occurrence of current speed for the midwater depth at 55 meters depth at the Millar Channel site for Sept. 24 to Oct. 23, 2011.

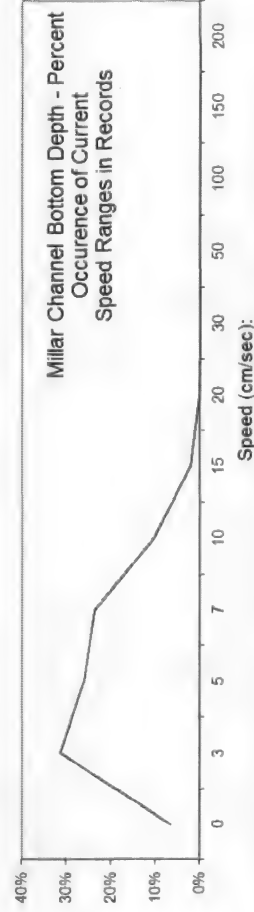


Figure 9. Percent occurrence of current speed for the lower depth at 106 meters depth at the Millar Channel site for Sept. 24 to Oct. 23, 2011.

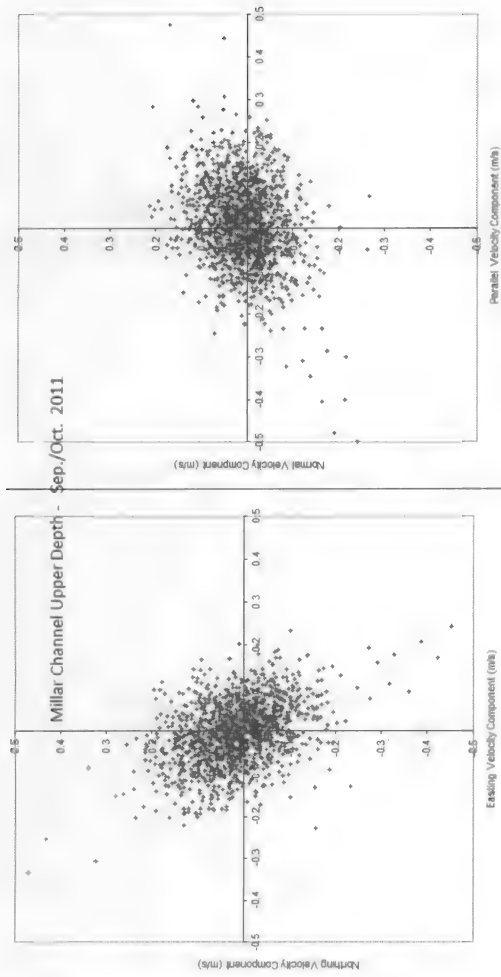


Figure 10. Scatter plots of current speed and directions for the upper depth.

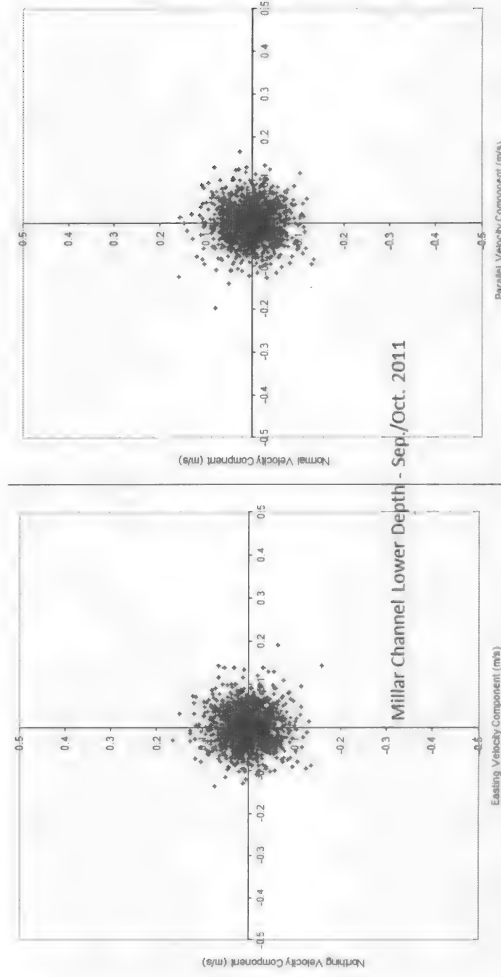


Figure 11. Scatter plots of current speed and directions for the midwater depth.

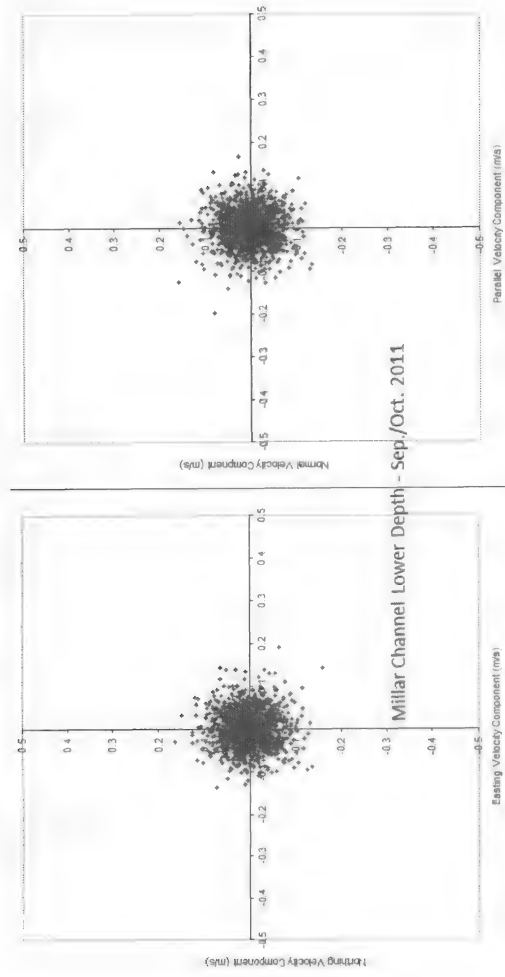


Figure 12. Scatter plots of current speed and directions for the bottom depth.

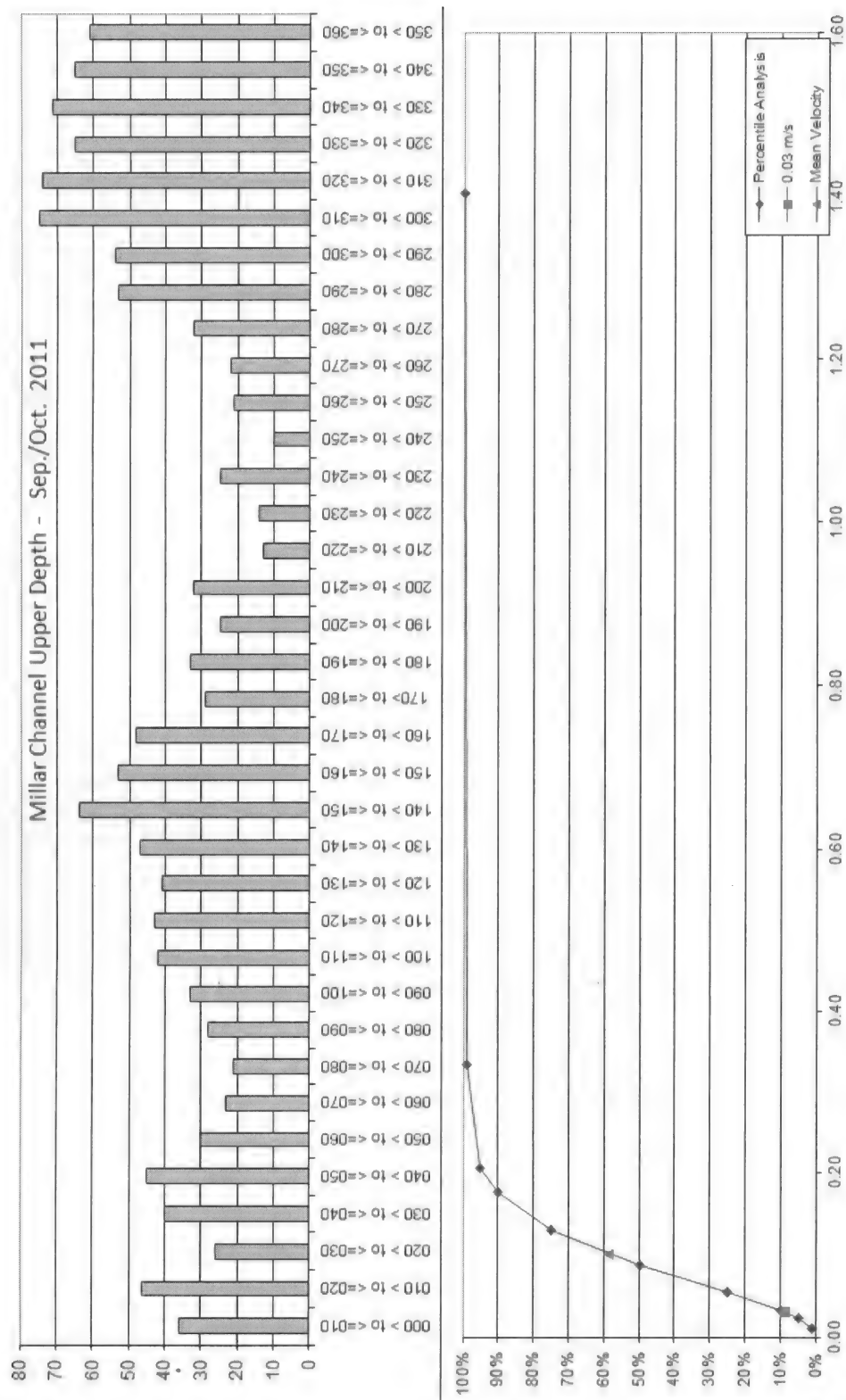


Figure 13. Frequency analysis plots of current direction and speed for the upper depth.

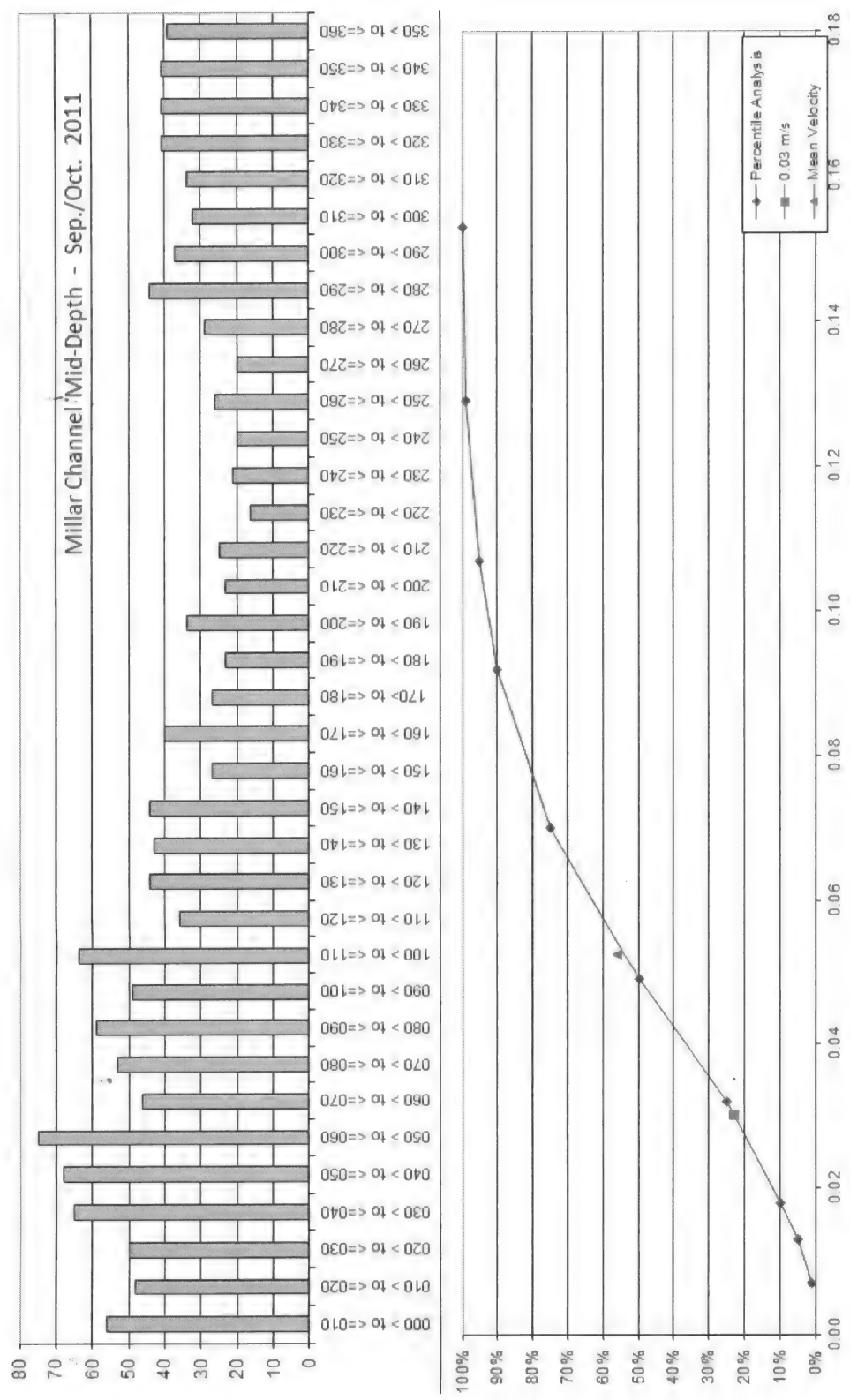


Figure 14. Frequency analysis plots of current direction and speed for the midwater depth.

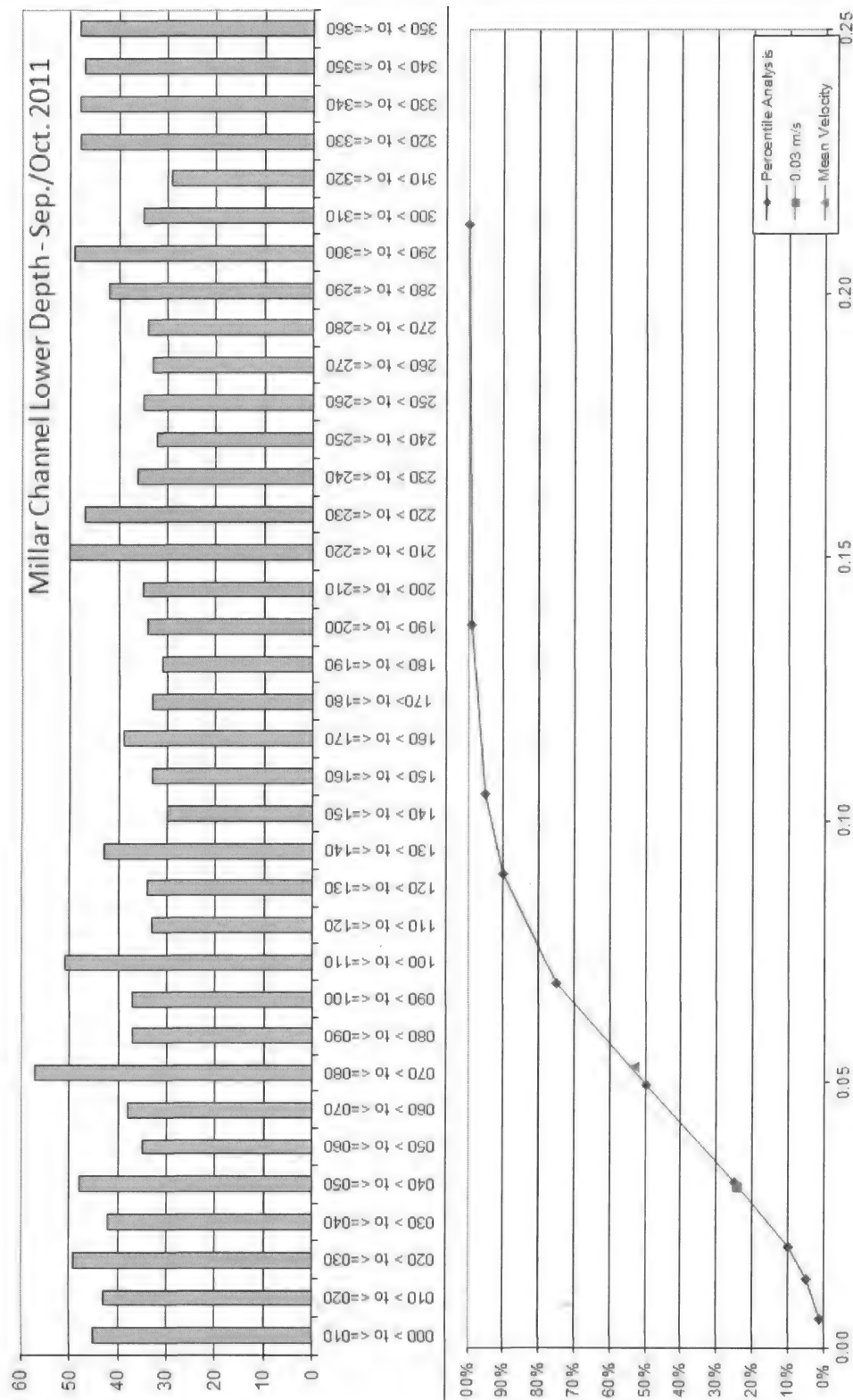


Figure 15. Time series plots of current speed and direction for the bottom depth.

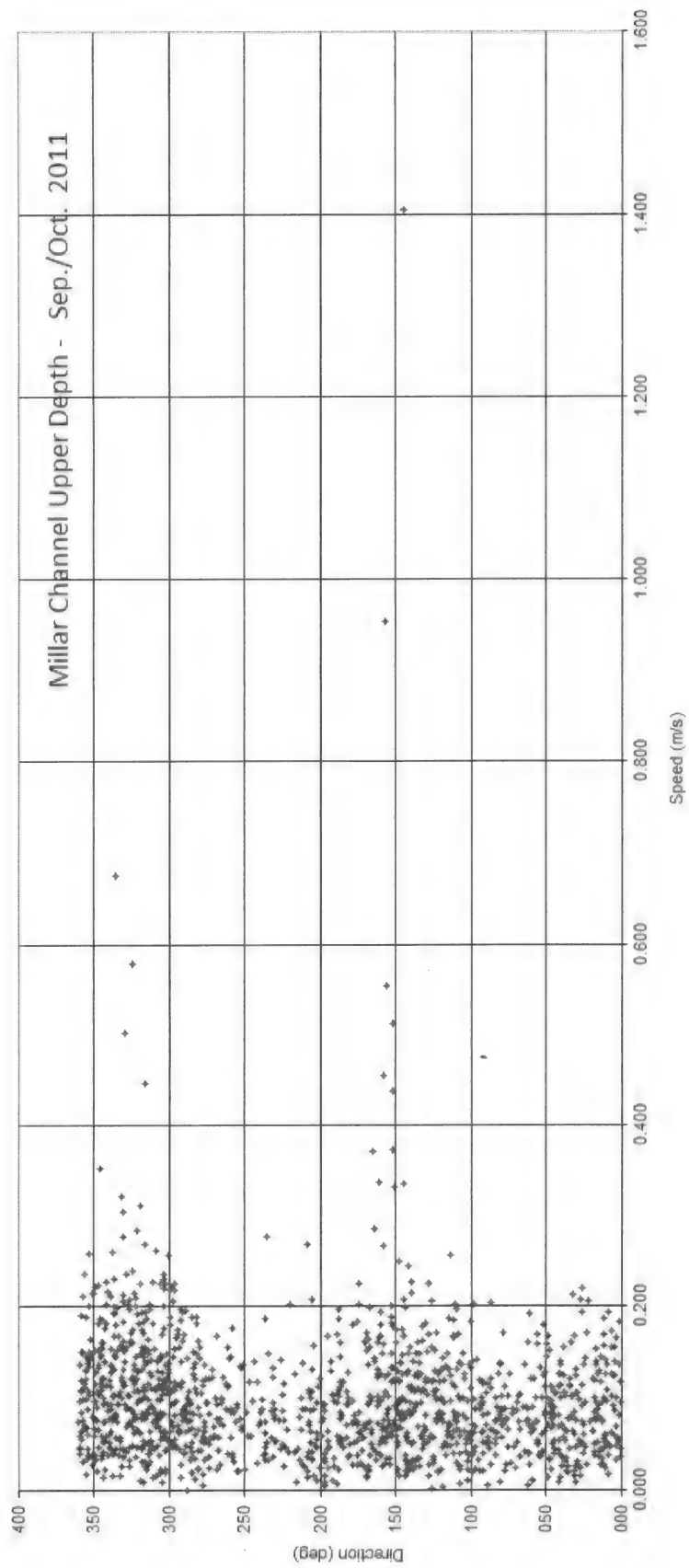


Figure 16. Speed versus direction plot for upper depth.

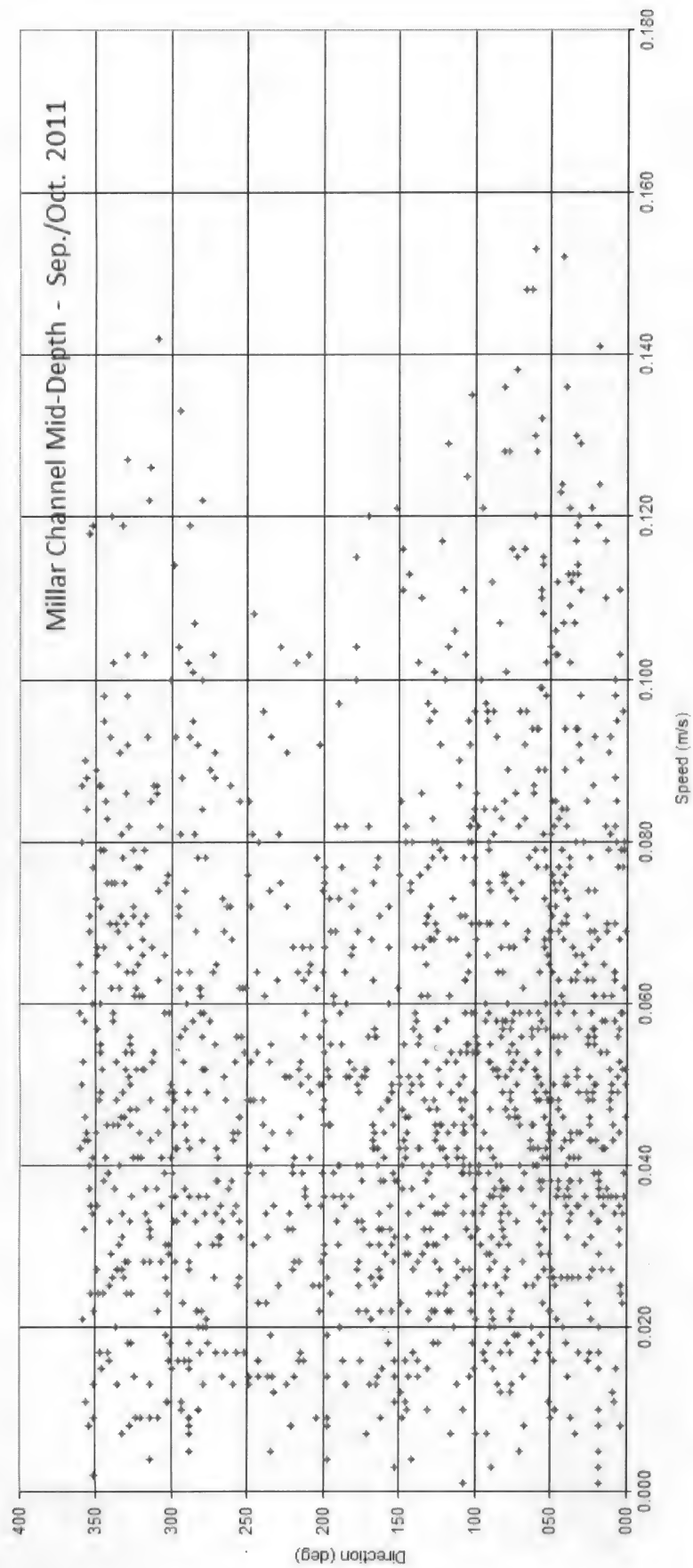


Figure 17. Speed versus direction plot for midwater depth).

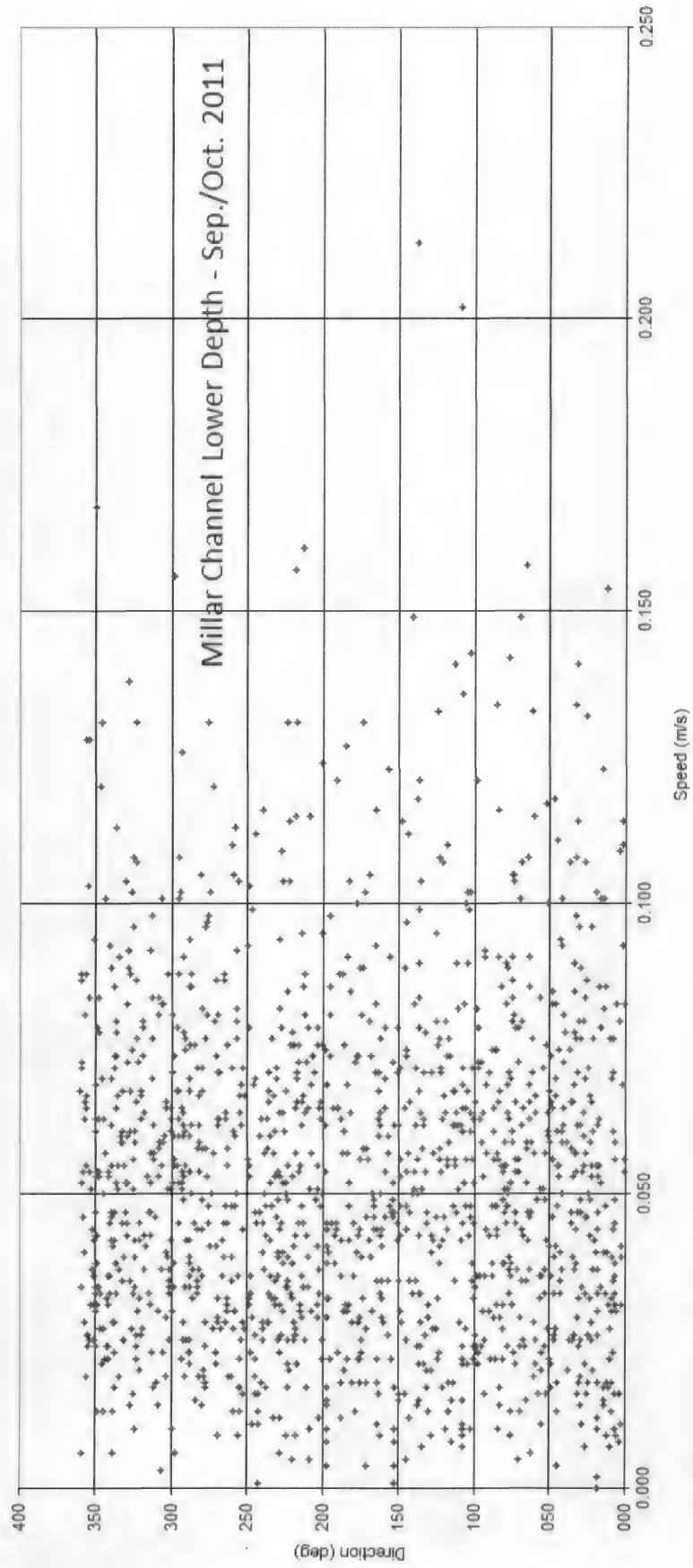


Figure 18. Speed versus direction plot for lower depth.

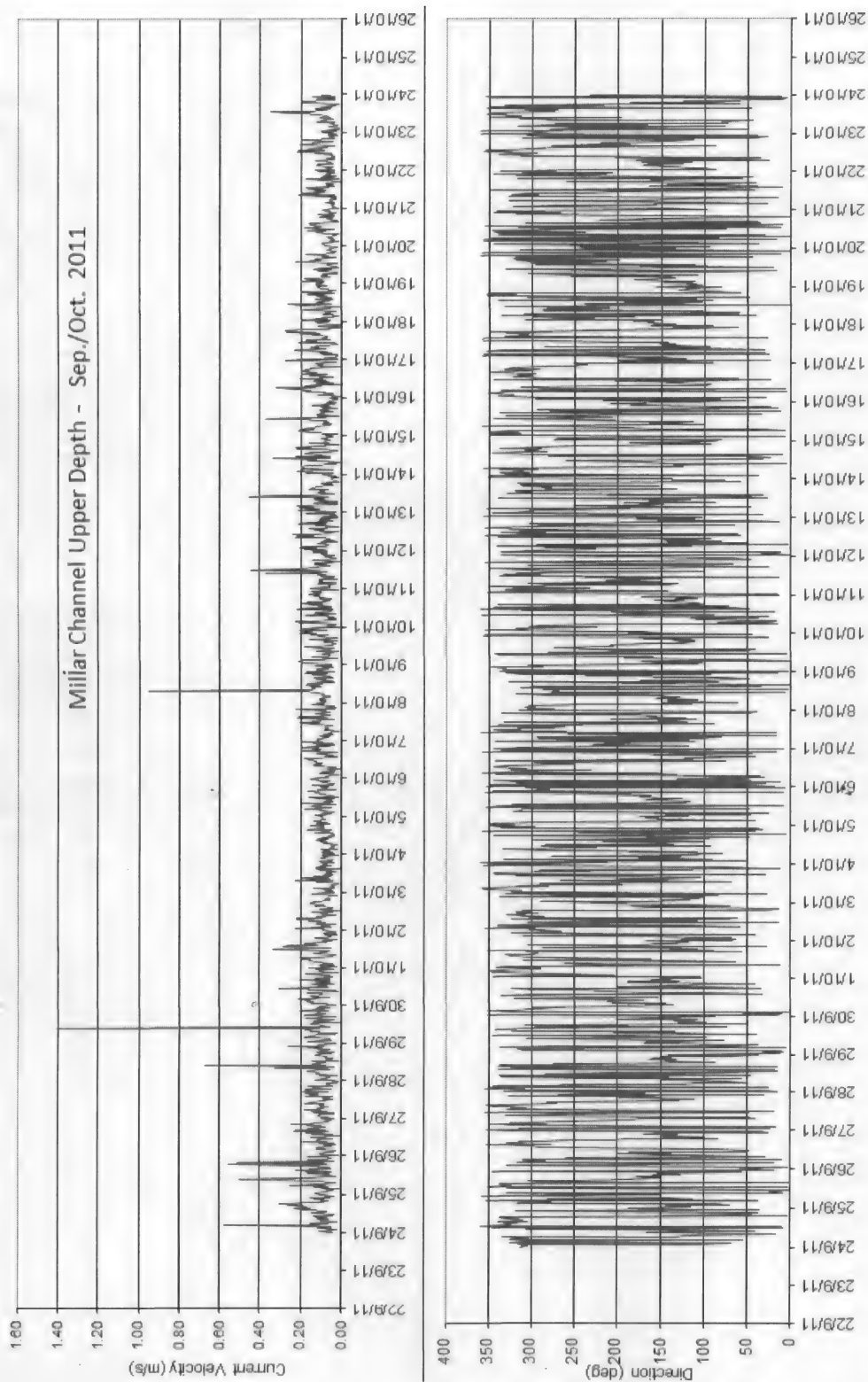


Figure 19. Time series plots of current speed and direction for the upper depth (note that velocity scale is quite different than mid-depth and bottom time series plots).

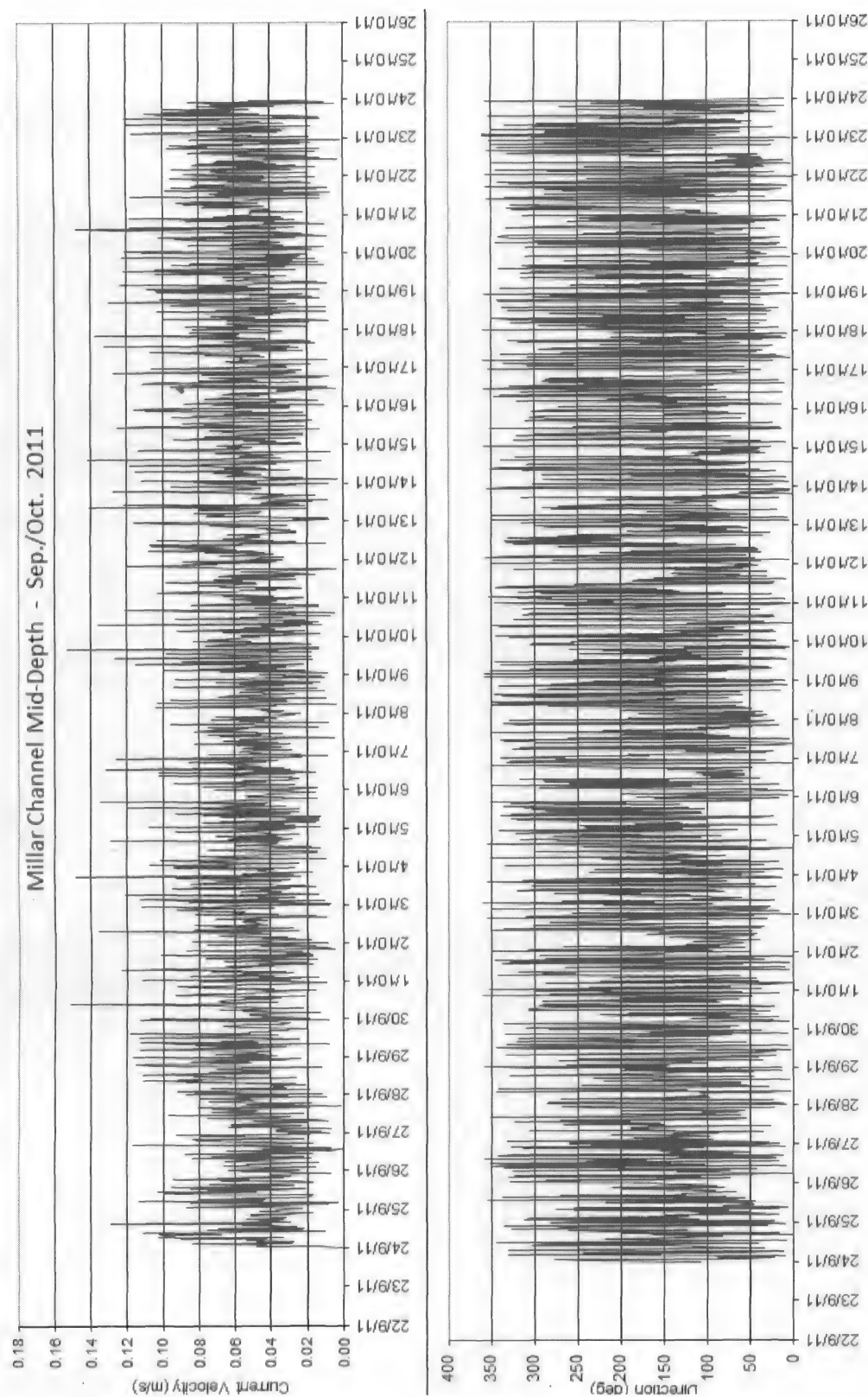


Figure 20. Time series plots of current speed and direction for the mid-water depth.

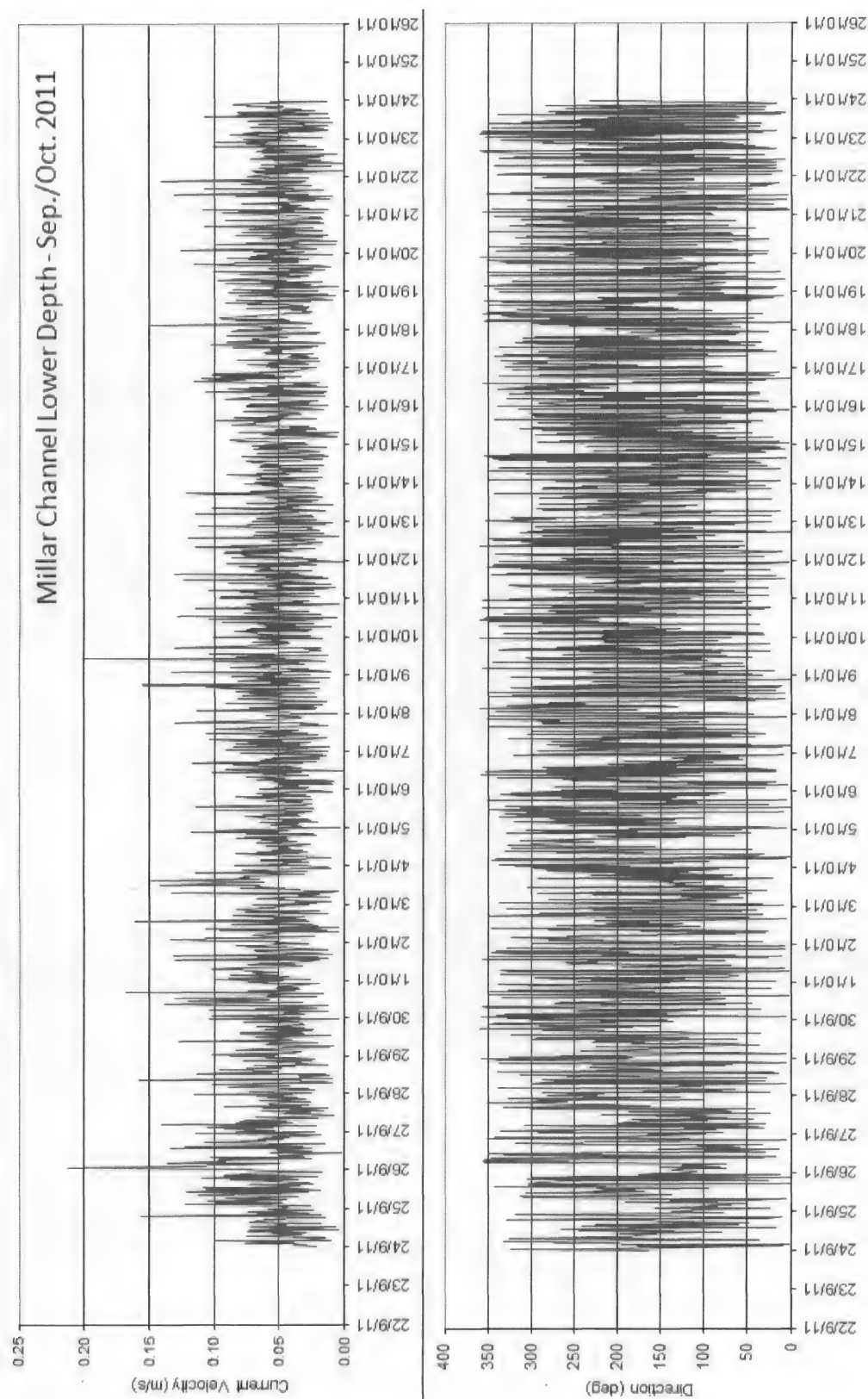


Figure 21. Time series plots of current speed and direction for the bottom depth.

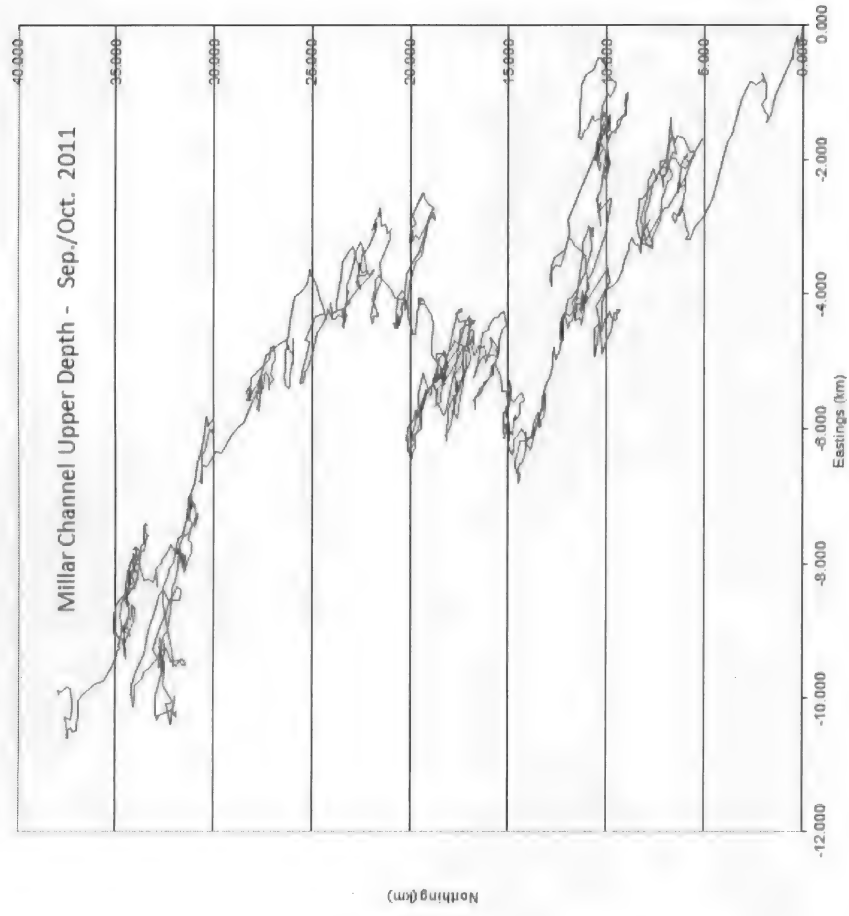


Figure 22. Cumulative vector plot for upper depth.

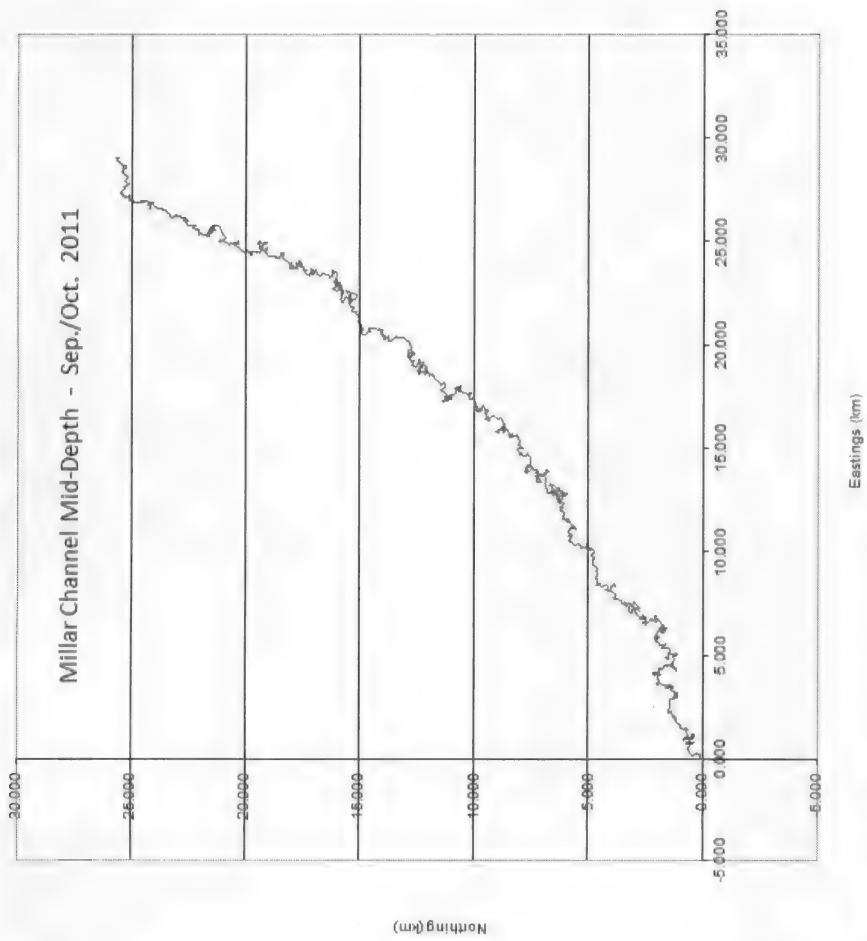


Figure 23. Cumulative vector plot for midwater depth.

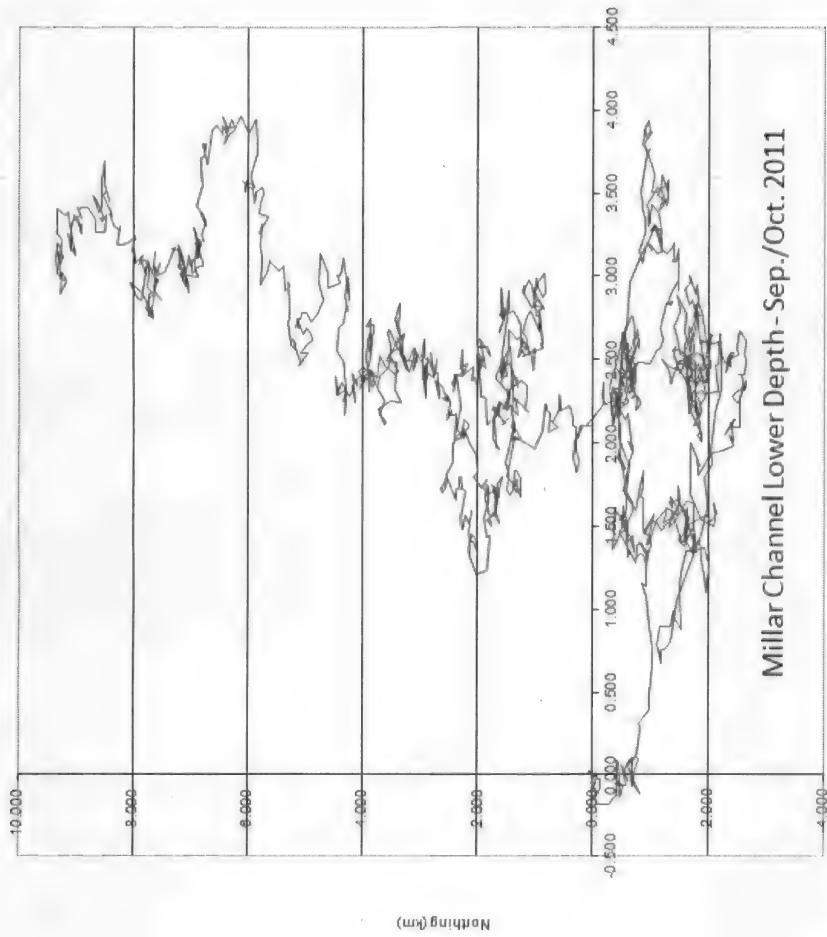


Figure 24. Cumulative vector plot for lower depth.

Contact re. deployment: Ocean Dynamics Canada Ltd. at oceandyn@shaw.ca

Contact regarding model simulations: [redacted] of IEC at [redacted]

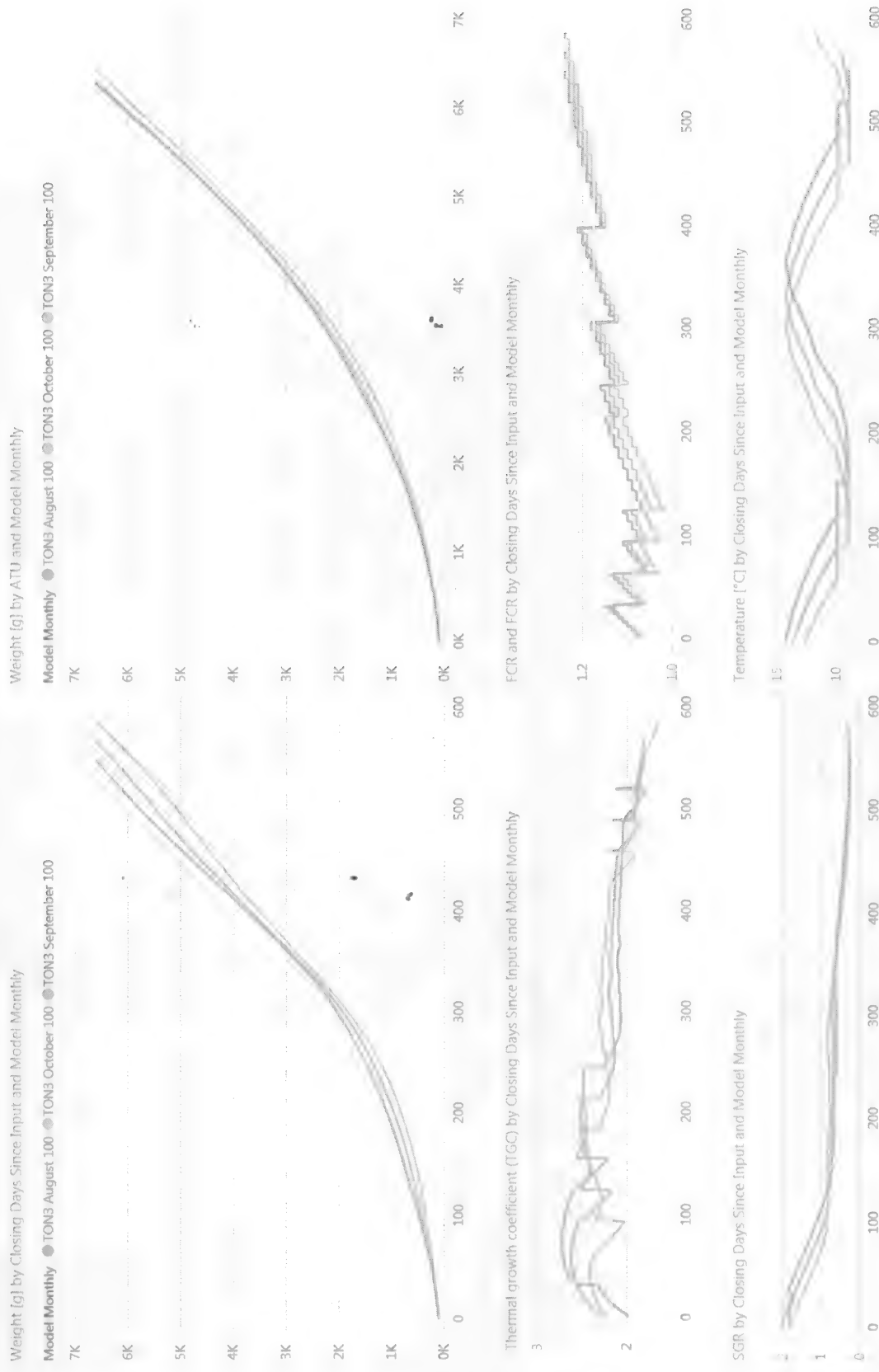
Also contained in appended file: Millar Ch DEPOMOD 2x6 Nov12 2012.zip

- o Raw current data
- o DEPOMOD files used in Grid generation, Particle tracking, and Resuspension modules
- o Associated shp files for pens and site boundaries.

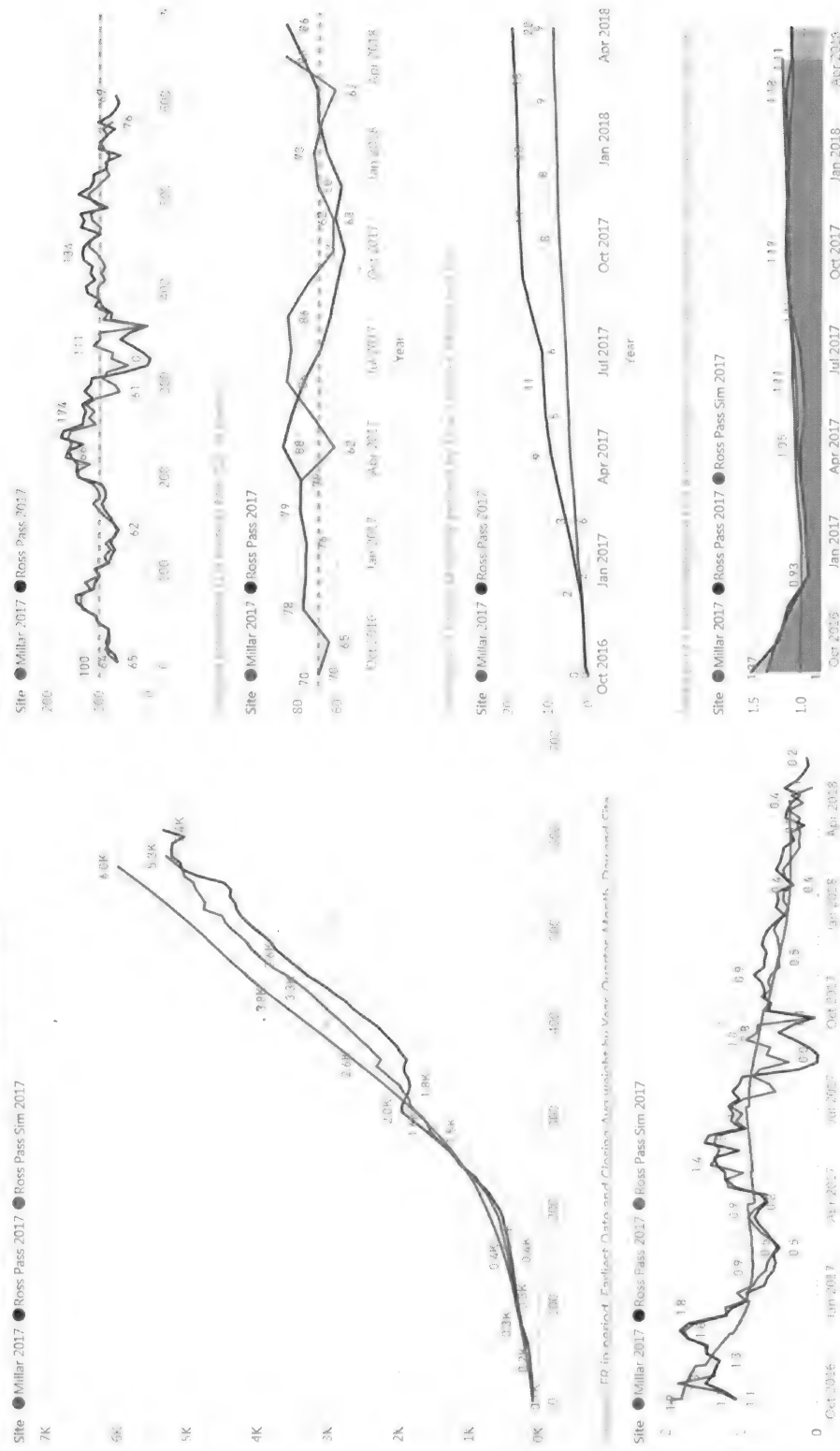
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Page 931
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3 different curves based on the S0 egi model with 100 gram inputs. Start of month entry's with days at sea and atu growth curves.



This is what Millar and Ross looked liked this YC with a 86 gram entry in late Sep.



Jones, Simon

From: Connors, Brendan
Sent: Tuesday, August 7, 2018 7:56 AM
To: Jones, Simon
Subject: RE: Possible collaboration? experimentally testing popn. level effects of sea lice on pinks

Follow Up Flag: Follow up
Flag Status: Completed

Categories: Yellow Category

Hi Simon.

A quick follow up email to see if you had a chance to ponder my email below.

I'm back in the in the office for the next several days [REDACTED] Let me know if you would prefer to chat over phone.

Thanks.

Brendan

From: Connors, Brendan
Sent: Monday, July 16, 2018 9:25 PM
To: Jones, Simon
Subject: Possible collaboration? experimentally testing popn. level effects of sea lice on pinks

Hi Simon,

[REDACTED]

I'm writing to inquire if you have any interest in potentially collaborating on a project (see attached draft proposal) that seeks to experimentally quantify the population level effects of sea louse infection on pink salmon. In a nutshell the idea is to release paired groups of SLICE-treated and placebo-treated juvenile pink salmon that are individually tagged (thermal otolith marks), and assess differences in marine survival between treated and untreated fish by counting how many of each group return to spawn 18ish months later. Despite some obvious limitations, I think such a manipulative experiment, which has never occurred in the Pacific but as you probably know has been done dozens of time in the Atlantic, would allow for strong inference about the population level effects of sea louse infection on wild Pacific salmon.

[REDACTED] Jeff Hutchings at Dalhousie) is leading the project and we had some initial discussions with the Nanaimo River Hatchery and the Snuneymuxw First Nation about the project, both of whom are very supportive. We propose the Nanaimo Hatchery because it already rears pinks and uses net pens, plus there is little natural production from system making recovering marked spawners more realistic. In order to proceed the Nanaimo hatchery (which is a community hatchery) would need SEP approval, and though we had some initial positive discussions with SEP, an internal review of the project led to the official decision to not support it at this time (also attached).

s.19(1)

[REDACTED] and I met with SEP last week to better understand their concerns. The take home from the meeting was that it would be much easier for SEP to sign off of the project if the merits of the project were recognized and articulated by others at DFO (i.e., in the Science and Fisheries and Aquaculture Management branches) and if others from Science were also involved. To this end: (1) I had a follow up conversation with Nathan Taylor who thought the proposal had strong merit and offered to follow up with Allison Webb and Andy Thomson about it, and (2) I offered to follow up with other researchers about prospects for collaboration. You are obviously a leader in the department when it comes to research into interactions between parasites and salmon and in addition to critical feedback on the current proposal you may have some interest and ideas about cool side investigations that could be paired with it.

I'll stop here given how long this email already is, and encourage you to drop me a note or give me a call sometime if you have any interesting in discussing this project and the potential to collaborate on it.

Many thanks for your consideration.

Brendan

s.19(1)

Shaw, Kerra

From: Jones, Simon
Sent: Tuesday, August 07, 2018 11:05 AM
To: Shaw, Kerra
Cc: Waddington, Zac; Paylor, Adrienne
Subject: FW: Sea lice management and resistance in Clayoquot Sound


Hi Kerra,

Just saw the out of office from Zac and Adrienne.

Cheers, Simon

From: Jones, Simon
Sent: August-07-18 11:04 AM
To: Waddington, Zac
Cc: Paylor, Adrienne
Subject: FW: Sea lice management and resistance in Clayoquot Sound

Hi Zac,

I haven't seen recent bio-assay data from farms in Clayoquot Sd, and cannot provide  an informed answer to his question.

In any event, your shop will likely have additional information to address this question.

Let me know if you require my input.


Best, Simon

Simon R.M. Jones
Acting Section Head AAH

*Aquatic Animal Health Section
Pacific Biological Station
Fisheries and Oceans Canada
3190 Hammond Bay Road
Nanaimo, British Columbia
V9T 6N7, Canada*

s.19(1)

Tel: 250 729 8351
Fax: 250 756 7053
E-mail: simon.jones@dfo-mpo.gc.ca

From: 
Sent: August-06-18 1:34 PM
To: Jones, Simon
Subject: Sea lice management and resistance in Clayoquot Sound

Document Released Under the Access to Information Act / Document divulgué en vertu de la Loi sur l'accès à l'information

Hi Simon,

My name is [REDACTED] the Cedar Coast Field Station, situated on Vargas Island here in Clayoquot Sound. This spring we were conducting juvenile salmon and sealice monitoring during the juvenile salmon out migration. The outbreak seen on farms in Clayoquot Sound this year also seemed to coincided with high abundance and prevalence of sea lice on the wild fry and smolts we were assessing in the region. We had a small survey this year but the fish we did find had lice loads much higher than was reported for juvenile salmon in the region during previous assessments.

There has been lots of talk about the use of hydrogen peroxide to treat sea lice on the Cermaq farms here, including discussing resistance to slice developing. I have heard lots of rumblings and rumours mentioning resistance developing but I have not heard anything from an official source. It is mentioned in one of Cermaq's permit applications for use of hydrogen peroxide around Campbell river, but they do not mention the location in which slice resistance lice were found. Is there any concrete evidence of slice resistance forming in BC or is the treatment with hydrogen peroxide here in Clayoquot Sound an attempt to reduce the potential for resistance by using an array of treatments?

All the best,

[REDACTED]

--

[REDACTED]
Cedar Coast Field Station
[REDACTED]

s.19(1)

McNabb, Melanie

From: [REDACTED]
Sent: August-10-18 5:01 PM
To: salmonITC / CITsaumon (DFO/MPO)
Cc: [REDACTED] Manchester, Howie; Charbonneau, Michelle; [REDACTED] Waddington, Zac
Subject: *Confidential: RE: ITC applications #S202 and S203 - ON HOLD
Attachments: 2019 Sealice Mitigation Plan Tofino North.pdf

Hello Zac,

Please find attached our Mitigation Plan for Sea Lice during the stocking of our Marine facilities in our Tofino North Operations.

Many Thanks,



CERMAQ

Phone +1 250-286-0022
Direct +1 250-286-0022 ext [REDACTED]
Mobile [REDACTED]

Cermaq Canada Ltd.
#203-919 Island Highway
V9W 2C2 Campbell River, BC, Canada

Cermaq.ca [Facebook](#) [Twitter](#)

From "salmonITC / CITsaumon (DFO/MPO)" <SalmonITC@dfo-mpo.gc.ca>
To [REDACTED], "salmonITC / CITsaumon (DFO/MPO)" <SalmonITC@dfo-mpo.gc.ca>
Cc [REDACTED], "Manchester, Howie" <Howie.Manchester@dfo-mpo.gc.ca>, "Charbonneau, Michelle" <Michelle.Charbonneau@dfo-mpo.gc.ca>, "Waddington, Zac" <Zac.Waddington@dfo-mpo.gc.ca>
Date 02/08/2018 03 14 PM
Subject RE ITC applications #S202 and S203 - ON HOLD

Hello [REDACTED]

As discussed, we'll be putting these applications on hold pending further information on updated sea lice management strategies for your Clayoquot sites. In the meantime, we will complete the review of fish health records and this week's site visit so that we are in a position to move forward with our assessment once those details have been provided.

Thank you,
Melanie

s.19(1)

Melanie McNabb
Governance Coordinator / Coordinatrice de la gouvernance
Fisheries and Oceans Canada, Pacific Region / Pêche et Océans Canada, région du pacifique
200 - 401 rue Burrard St, Vancouver, BC V6C 3S4
Tel / tél (604) 666-6894
Fax / téléc (604) 666-1076
e-mail / courriel melanie.mcnabb@dfo-mpo.gc.ca

From: [REDACTED]
Sent: July-20-18 4:59 PM
To: salmonITC / CITsaumon (DFO/MPO)
Cc: [REDACTED] Manchester, Howie; Charbonneau, Michelle
Subject: *Confidential: Application for transfer of Smolts from Ocean Farms (#180) to Marine Facilities - Dixon (#234), Millar (#1507) & Ross (#526)

Hello,

Please find attached an applications for a licences to transfer fish from our Ocean Farms Hatchery to our marine facilities Dixon, Millar & Ross Pass (Clayoquot Region).

Should you have any questions please let me know

Many Thanks,

[REDACTED]

CERMAQ

Phone +1 250-286-0022
Direct +1 250-286-0022 ext. [REDACTED]
Mobile + [REDACTED]

Cermaq Canada Ltd
#203-919 Island Highway
V9W 2C2 Campbell River, BC, Canada

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Any unauthorised use, dissemination of the information or copying of this message is prohibited.

CERMAQ

Zac Waddington
Fisheries and Oceans Canada
Aquaculture Management Division, Snr FishVet
#103 – 2435 Mansfield Drive ,Courtenay, BC

Campbell River, 10 August 2018

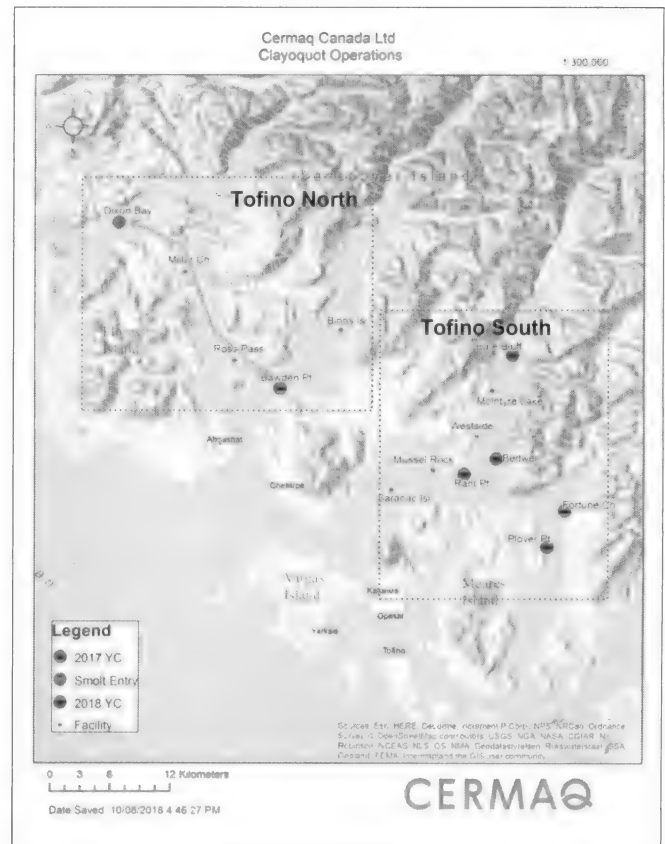
2019 Clayoquot Sound (Tofino North) Sea Lice Management Plan

Dear Zac,

Please find below the measures that Cermaq Canada is putting into place to mitigate against sea lice during the entry of our 2019 Year Class Smolts into the Clayoquot Sound Region.

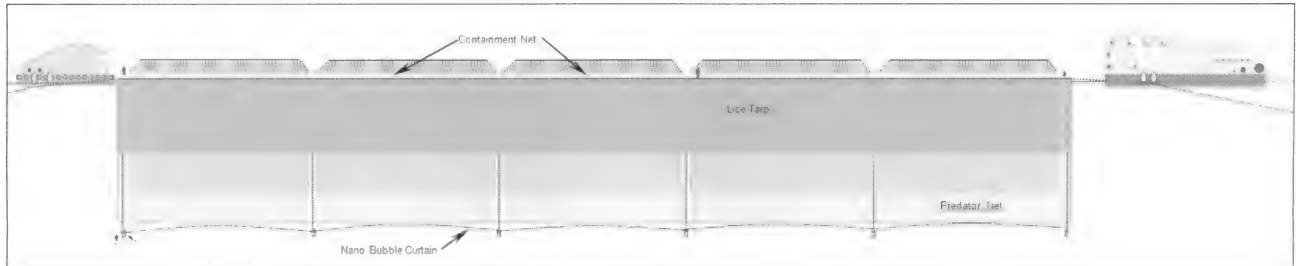
2018 Fall Smolt Entry Location

- All Fall smolt entries will be entered into Tofino North area only.
- The last of 2017YC will be harvested out of Tofino North before any entry of 2019YC.
- As of August 8th we started harvesting the last 2017 YC fish in Tofino North (Bawden). Harvesting from Bawden has been accelerated and involves maximizing the processing capacity of both Tofino and Brown's Bay processing plants.
- Last day of harvest for Bawden is August 28th.
- The first smolts going into Tofino North will be entered at Dixon on August 29th.
- Dixon was chosen because it is the farthest site from Bawden with 16km distance between them with predominant current flow through Sidney and Shelter Inlet and not from Millar Channel.



Infrastructure Mitigation

- Receiving site will be set up with sea lice skirts deployed (10m depth) and 25m deep bubble curtains and diffusers running.
- Skirts and bubble curtains will be running for 2 weeks prior to smolt entry.



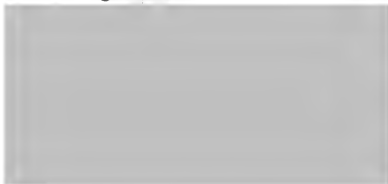
Therapeutant Mitigation

- EDR applications for Imvixa (Lufenuron) have been submitted for 1.8 million smolts coming from Boot Lagoon and Oceans Hatchery. Once made available this product will be used on the earliest possible smolt transports.
- For this product to be available for the first smolts it must be available by August 15th. If available after August 15th the product will still be used but on subsequent smolt entries.
- If Lufenuron is not available for the first smolts we will take the added precaution of treating with SLICE in the hatchery those smolts that will not receive Lufenuron. This is routine on the East Coast of Canada with good results preventing larval lice settlement. Our SLICE bioassays from Tofino indicate that younger life stages are still sensitive to SLICE even when adults of the same population are highly resistant.

Further Consideration

- Smolts have already been delayed 10 days to meet the August 29th entry and cannot be delayed any further. Further delays would result in significant fish welfare issues in the hatcheries due to density and saprolegniosis. Fish have already been triggered for entry via photoperiod manipulation.

Kind regards



Cermaq Canada Ltd

Email:



CC: Melanie McNabb (Governance Coordinator) SalmonITC@dfo-mpo.gc.ca

s.19(1)

Hedderson, Lisa

From: Hedderson, Lisa
Sent: August-13-18 1:13 PM
To: 'Myron.Roth@gov.bc.ca'
Subject: FW: Draft FAIAP minutes
Attachments: Draft FAIAP_Meeting_Summary July 31 2018 (3).docx

FYI, as requested

Lisa Hedderson

Aquaculture Management Coordinator
Telephone | Téléphone **250.754.0407**

From: Taekema, Bernie John
Sent: August-13-18 11:51 AM
To: Hedderson, Lisa
Subject: Draft FAIAP minutes

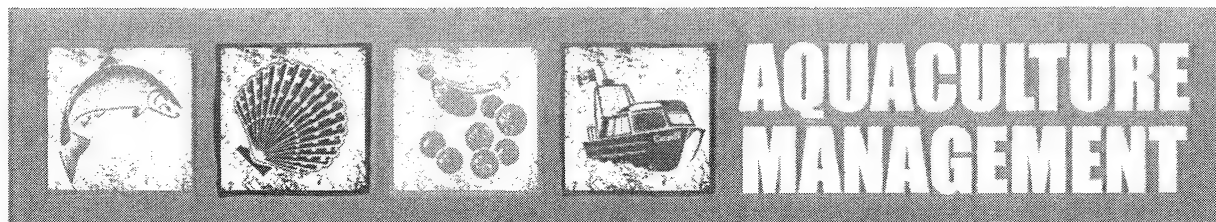
Hi Lisa,

Please forward the attached minutes to all FAIAP members and ask that they send in any comments within the next couple of weeks and follow-up on action items as appropriate.

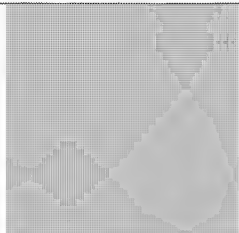
Thanks

Bernie Taekema
Senior Aquaculture Management Coordinator
1965 Island Diesel Way
Nanaimo BC V9S 5W8
phone: 250 754-0398
cell: [REDACTED]

s.16(2)(c)



**FISHERIES AND OCEANS CANADA (DFO)
FINFISH AQUACULTURE INDUSTRY ADVISORY PANEL (FAIAP)
MEETING SUMMARY (DRAFT)**

Meeting Date:	July 31, 2018, 9:00 am – 12:00 pm	
Location:	DFO Regional Headquarters, 401 Burrard St, Vancouver BC Conference Call#: 1-877-413-4781 / Passcode: [REDACTED]	
MEETING OBJECTIVES:	<ul style="list-style-type: none">• Provide updates on the BC Aquaculture Regulatory Program• Discuss and seek feedback from committee members on initiatives and issues	
Materials Distributed:	<ul style="list-style-type: none">• July 31, 2018 FAIAP Meeting Agenda• July 31, 2018 FAIAP Action Items• Draft May 2, 2018 FAIAP Meeting Summary• Status of Marine Finfish Harmonized Aquaculture Applications	
Attendees		
Industry	DFO	Province of BC
	Allison Webb Lauren Lavigne Bernie Taekema Shelley Meadows Brenda McCorquodale Zac Waddington	Lesley Fettes

1. Welcome, Introductions, and Overview of the Agenda (A. Webb)

- A. Webb noted the new Minister (Jonathan Wilkinson) and briefings occurring in Vancouver this week.

2. Review of Action Items from May 2, 2018 FAIAP Meeting (A. Webb)

- DFO and industry provided updates on the status of their respective action items (refer to attached action items list).

-Short discussion on biosecurity and recent/expected court rulings. If court rules in favor of the fish farm companies industry suggested that DFO or the province imbed biosecurity regulations in legislation.

-It was noted that a constructive meeting hosted by MOE with industry and DFO regarding fish processing plan effluent occurred and further follow up meetings are expected to modernize the permit process.

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- **ACTION ITEM:** DFO to follow-up with MOE with regard to pathogen management at fish processing plants and associated permit requirements.
- The meeting agenda was reviewed and accepted as distributed. Minutes of the May 2, 2018 meeting were also approved.

Federal Update - (L. Lavigne)

- As of August 27th, 2018, L. Lavigne will be leaving on an assignment. An update on her replacement will be provided shortly.
- DFO is currently running a staffing process to create a pool of qualified Aquatic Health Veterinarians. Candidates will be interviewed and the goal is to have a new veterinarian in place by September.
- DFO is also working toward creating a position to establish epidemiological expertise within the Fish Health Audit and Surveillance Program (FHASP).
- DFO suggested updating the standards for circulating meeting minutes/action items as follows:
 - Minutes circulated to industry within two weeks;
 - Call for agenda items five weeks prior to next meeting – one week for a response;
 - Draft agenda circulated to FAIAP membership along with meeting invite four weeks prior to next meeting;
 - Agenda and attachments sent to committee members two weeks prior to meeting.

3. Aquaculture Program Updates

Applications: Status and number of current applications (B. Taekema)

- DFO circulated an updated spreadsheet to reflect the status of current aquaculture applications under review and provided a brief summary of the status of each application.
- Industry questioned how sites will be impacted by BC's new policy post-2022, as well as in the interim, particularly with regard to Federal licence amendments.

Strategic Working Group (SWG) updates (L. Lavigne)

- SWG met on May 4 and July 26, 2018. The SWG is working to further define the use of performance based standards as well as options for enhancing indigenous participation in aquaculture activities.
- DFO has requested that industry provide a list of First Nation representatives involved in aquaculture activities who could participate in upcoming joint SWG and FNFC Aquaculture Coordinating Committee Meeting (ACC) in September.
 - ACTION ITEM:** Industry to provide list of First Nation representatives.
- Performance based metrics: DFO is looking at developing an approach related to fish health (i.e. sea lice, mortality) and subsequently expand to other aspects (related to Precautionary Approach – see below).
 - ACTION ITEM:** The SWG will set up a meeting with departmental and industry

fish health representatives to scope out a proposal that will be presented to FAIAP.

- Precautionary approach: Recent audits have suggested that DFO does not clearly explain how the precautionary approach is being considered when making decisions. It is important to be able to explain this to respond to these external recommendations and increase public confidence in the robustness of the regulation of the industry. DFO is currently drafting documents to explain how the precautionary approach is used and the performance based metrics being developed by the Strategic Working Group for fish health will be included as part of this framework.
 - An example of the precautionary approach DFO takes is the sea lice threshold in licence conditions that are designed to minimize sea lice loading at farms during the wild salmon smolt out-migration period.
- Discussed a traffic light system approach to regulating the industry. Norway and Chile use this approach.
- The draft Salmon Transfer Report (with fish health information) will be made available for discussion at the September 7, 2018 SWG meeting.

Reconciliation/Indigenous participation in aquaculture (L. Lavigne)

- Update of recent FNFC ACC meeting, where First Nations noted that their key priorities are in the areas of science, data gathering and monitoring. The SWG developed the following list of ideas related to this topic:
 - Establish a First Nation focus group with a broad spectrum of views (pro and anti-aquaculture) to solicit ideas on how to engage First Nations in aquaculture
 - Invite First Nations who are currently participating in aquaculture activities (such as sea-lice monitoring) to attend FNFC ACC meetings
 - Work with industry to support First Nation youth enrolment in biology programs (i.e. North Island College) to enhance science literacy and capacity
 - Invite ACC members to the next BCSFA Collaboration on the Coast workshop
 - Extend invitation to First Nations partners to attend SWG meetings
 - Develop list of First Nations that may be interested in technical workshops with DFO on specific issues related to aquaculture (i.e. disease management etc.)
- **ACTION ITEM:** DFO will continue to work with the Strategic Working Group on Indigenous engagement.

4. Broughton Update (L. Fettes)

- BC is continuing to move forward with the Government-to-Government process that includes the three Broughton nations that have signed a letter of understanding (LOU). Consultation requirements are beyond these three nations, but BC is not clear on the consultation process at this point.

- Recommendations related to the LOU to provincial decision-makers on options for the Broughton tenures are due by September 30, 2018. In the interim, the Province will continue to consider each application on a case-by-case basis.
- Given that there are outstanding questions on how the new BC policy will be operationalized and its implications on DFO's management of the industry including licensing and consultation DFO will be meeting with BC to discuss a path forward.
- Industry is going to request a meeting with the province to discuss their June announcement concerning the renewal of tenures and will be requesting DFO's attendance. Industry expressed concern about the province's statement that salmon farming is detrimental to wild salmon without including scientific evidence to back that up.
- With regard to the application process DFO and BC encourage industry to come to agreement with First Nations prior to submitting an application.
- There is agreement that Industry and government (federal and provincial) need to build an enduring relationship with First Nations such that they have confidence in the aquaculture industry.
- **ACTION ITEM:** DFO to follow up with BC re operational questions on new BC policy for aquaculture sites and provide information back to industry in early fall.

5. Integrated Pest Management (B. Taekema)

- B. Taekema provided a summary of a May 14, 2018 call between DFO and MOE where each agency's respective roles and responsibilities related to Integrated Pest Management were discussed.
- DFO will be meeting with Province on this topic in two weeks.
- Industry expressed concern about the provincial requirement to consult with First Nations for every peroxide use (condition of pest management permits). This may affect industry's ability to meet DFO licence conditions.
- DFO has invited MOE to participate in a future SWG meeting to provide industry information and answer questions on IMP.
- **ACTION ITEM:** DFO to follow up with BC on input to changes to MOE pesticide use permit requirements.

6. Communications - Major Farm Events (L. Lavigne)

- DFO requested that should there be a major farm event (i.e. a major fish die off) the Department should be contacted as a courtesy prior to approaching the media.

7. Sea Lice Update (Z. Waddington)

- Discussion on present management approach for sea lice and where improvements can be made.
- Slice resistance first noted in BC in 2012. Harvesting, as an alternate management action, not achieving the goal of reducing sea lice abundance. It has been the only alternative to Slice until relatively recently when hydrogen peroxide was authorized.

- Potentially three well boats used for hydrogen peroxide treatment will be in use next year along with a hydro-licer.
- Industry requires more treatment options.
- A performance management review of Slice use is required so as to better understand how to use it most effectively and timely (focus on time of out-migration) moving forward.
- DFO considering options and will be in discussions with industry in future.

8. Indigenous Engagement (B. McCorquodale)

- The federal government has committed to four priority areas for reconciliation:
 - Better internal coordination between DFO groups, including aquaculture, when negotiating with First Nations
 - Identify priority areas of First Nation interest such as monitoring and science and establish an area based approach to initiate community involvement.
 - Economic development opportunities
 - Establish a collaborative relationship with Industry to advance reconciliation approaches.

9. BCSFA Update

- An announcement on the new BCSFA Executive Director will be forthcoming in two weeks.
- The AGM is scheduled for September 27-28, 2018. The DFO Minister has been invited to attend.
- Marine Harvest will be advertising for a new Managing Director to be in place by mid-October.
- Industry expressed concern that MOE is moving too quickly on the development of new permit requirements associated with fish processing plants and wondered if MOE has contacted DFO regarding fish health aspects. Industry has not seen any draft permit requirements to date and is concerned about MOE's lack of engagement.

10. Roundtable

- Industry requested farm security stay on the agenda as it remains a hot topic.

Next meeting Date: October 30, 2018.

Manchester, Howie

From: Manchester, Howie
Sent: August-13-18 4:23 PM
To: [REDACTED] Charbonneau, Michelle; Stenhouse, Shawn
Cc: [REDACTED] Waddington, Zac
Subject: RE: Cermaq DFO Audits August 28-29

Hi [REDACTED]

I have a few questions.

My understanding is that Bawden will be harvested out soon , will this site still have fish by the time of our audit, (August 28 – 29)?

Are there any active sites from the list you sent us at the beginning of the quarter that are not included in the SLICE treatment that we can then reselect for lice counts?

The list included: Fortune, Rant Point, Bare Bluff, Bawden, Bedwell and Plover.

Please keep us updated,

Thanks

Howie

From: [REDACTED]
Sent: August-10-18 12:38 PM
To: Manchester, Howie; Charbonneau, Michelle; Stenhouse, Shawn
Cc: [REDACTED]
Subject: Cermaq DFO Audits August 28-29

Hello

We may have to look at your DFO site audit schedule for August. Do to increase counts of Caligus at some West Coast sites that is causing fish welfare concerns we will be treating with Enamectin Benzoate (Slice) starting on August 13th, 2018. The sites that will be treated include Bedwell, Fortune and Bawden which you have scheduled for August 28th and 29th.

Just wanted to give you the heads up. Once I have more info on things I will let you know

Regards



s.19(1)

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Waddington, Zac

From: Waddington, Zac
Sent: August-14-18 5:20 PM
To: 'Emergency Drug Release / Distribution de médicament d'urgence (HC/SC)'
Subject: RE: Revisions: Emergency Drug Release applications for Imvixa (10% lufenuron) use in BC

That is excellent. Thanks very much for your assistance in this matter, and I do not want to rush your due diligence. I only ask since the effective management of lice in this area is very much contingent upon an additional treatment option, and this EDR seems very well suited to provide sea lice mitigation in the period before their mechanical removal tool (the hydrolicer) arrives in the spring of 2019.

Zac

From: Burke, Julie (HC/SC) [<mailto:julie.burke@canada.ca>] **On Behalf Of** Emergency Drug Release / Distribution de médicament d'urgence (HC/SC)
Sent: August-14-18 6:49 AM
To: Waddington, Zac
Subject: RE: Revisions: Emergency Drug Release applications for Imvixa (10% lufenuron) use in BC

Hi again,

We spoke with the requesting veterinarian yesterday and the environmental assessor from HECS. Their report is the final piece we need to go ahead with an authorization and they will try to get it to us today. In order for Cermaq to go ahead, we are under the impression that our approval would need to be received by tomorrow. We're doing everything we can to make it happen, as long as HECS is able to provide a response shortly.

From: Waddington, Zac [<mailto:Zac.Waddington@dfo-mpo.gc.ca>]
Sent: 2018-08-13 8:44 PM
To: Emergency Drug Release / Distribution de médicament d'urgence (HC/SC)
Subject: RE: Revisions: Emergency Drug Release applications for Imvixa (10% lufenuron) use in BC

I have had the chance to speak with the company veterinarian for Cermaq, and have been briefed as to their area-based management plan for sea lice in the Clayoquot area. I was made aware that their revised plan involved a change in dates, and sites which fish would be stocked into, I support this plan fully since it allows for segregated years classes in the Tofino area, and is a demonstration of area-based management. However, a key component of this plan is the use of Imvixa, and based on their production plan and current smoltification of fish to be transferred, they would need to have the product in use by August 15th. I am aware this is an extremely tight timeframe, and I was curious if the VDD had an estimation as to whether or not this would be possible?

Thanks,

Dr. Zac Waddington DVM, B.Env.Sc.(Hons)
Lead Veterinarian - Pacific Region
Fisheries and Oceans Canada | Pêches et Océans Canada
Aquaculture Environmental Operations - Fish Health
Courtenay, British Columbia
Telephone | Téléphone: 250-703-0902
Fax | Télécopieur: 250-703-0921
Zac.Waddington@dfo-mpo.gc.ca

From: Burke, Julie (HC/SC) [mailto:julie.burke@canada.ca] **On Behalf Of** Emergency Drug Release / Distribution de médicament d'urgence (HC/SC)
Sent: August-13-18 10:36 AM
To: Waddington, Zac
Subject: Revisions: Emergency Drug Release applications for Imvixa (10% lufenuron) use in BC

Good morning Dr. Waddington,

This morning we received an email from Cermaq about changes to the stocking plan for the Imvixa treated salmon smolt. The original plan is outlined below. The new stocking plan is as follows:

DVM	Hatchery	Marine Sites	# fish	Quantity Imvixa	Time of transfer to sea
	Oceans	Dixon Millar Bawden		30 kg	Aug 29-Oct 13
	Boot Lagoon	Dixon Millar Bawden		30 kg	Aug 29-Oct 13

Can you let us know if you have any concerns or objections to the new proposal?

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s.20(1)(b)

Thank you,
Julie

From: Burke, Julie (HC/SC) **On Behalf Of** hc.edr-dmu.sc@canada.ca
Sent: 2018-07-12 12:36 PM
To: 'zac.waddington@dfo-mpo.gc.ca'
Subject: Emergency Drug Release applications for Imvixa (10% lufenuron) use in BC

Good afternoon Dr. Waddington,

The Veterinary Drugs Directorate has received two applications from Cermaq Canada Ltd. for the treatment of Atlantic salmon smolt with Imvixa this fall in hatcheries in British Columbia. Some of the request details are provided in the table below:

DVM	Hatchery	Marine Sites	# fish	Quantity Imvixa	Time of transfer to sea
	Oceans	Ross Millar Saranac		30 kg	Oct / Nov
	Boot Lagoon	Ross Millar Saranac		30 kg	Oct / Nov

Prior to authorizing requests for Imvixa, we confirm with a provincial representative that there is a significant sea lice infestation at the proposed marine sites, and that there are no concerns or objections to the treatment plan. Can you let us know whether or not you are in agreement with the veterinarian's proposals, or if you have any other comments.

Thank you,
Julie Burke, DVM
Acting Emergency Drug Release Officer

Emergency Drug Release, Veterinary Drugs Directorate
Health Canada / Government of Canada
hc.edr-dmu.sc@canada.ca / tel: 613-240-3916 / fax: 613-946-1125

Distribution de médicaments d'urgence / Direction des médicaments vétérinaires
Santé Canada / Gouvernement du Canada
hc.edr-dmu.sc@canada.ca / tél: 613-240-3916 / télécopie: 613-946-1125

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McNabb, Melanie

From: Waddington, Zac
Sent: August-14-18 6:27 PM
To: [REDACTED] salmonITC / CITsaumon (DFO/MPO)
Cc: [REDACTED] Manchester, Howie; [REDACTED]
Subject: RE: *Confidential. RE: ITC applications #S202 and S203 - ON HOLD

Thank you very much for providing that documentation of your planned stocking and lice mitigation activities in Tofino north. I have been in contact with the EDR department of Health Canada in order to try and expedite the approval process for Imvixa such that all smolts being restocked into Clayoquot would be able to be treated and thereby have efficacious lice mitigation prior to arrival of Cermaq's hydrolicer.

I am currently away from the office [REDACTED] but I would like to try and arrange a time to discuss the alternative mitigation strategies suggested by Cermaq if the EDR for Imvixa fails to come through in time. I will be available on Friday for a discussion, and by then we should know if the EDR has arrived in time for the Imvixa treatment to occur for all smolts to be transferred to Tofino north.

Zac

From: [REDACTED]
Sent: August-10-18 5:01 PM
To: salmonITC / CITsaumon (DFO/MPO)
Cc: [REDACTED] Manchester, Howie; Charbonneau, Michelle; [REDACTED] Waddington, Zac
Subject: *Confidential: RE: ITC applications #S202 and S203 - ON HOLD

Hello Zac,

Please find attached our Mitigation Plan for Sea Lice during the stocking of our Marine facilities in our Tofino North Operations.

Many Thanks,



CERMAQ

Phone +1 250-286-0022
Direct +1 250-286-0022 ext. [REDACTED]
Mobile + [REDACTED]

Cermaq Canada Ltd.
#203-919 Island Highway
V9W 2C2 Campbell River, BC, Canada

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s.19(1)

From "salmonITC / CITsaumon (DFO/MPO)" <SalmonITC@dfo-mpo.gc.ca>
To [REDACTED], "salmonITC / CITsaumon (DFO/MPO)" <SalmonITC@dfo-mpo.gc.ca>
Cc [REDACTED], "Manchester, Howie" <Howie.Manchester@dfo-mpo.gc.ca>, "Charbonneau, Michelle" <Michelle.Charbonneau@dfo-mpo.gc.ca>, "Waddington, Zac" <Zac.Waddington@dfo-mpo.gc.ca>
Date 02/08/2018 03:14 PM
Subject RE ITC applications #S202 and S203 - ON HOLD

Hello [REDACTED]

As discussed, we'll be putting these applications on hold pending further information on updated sea lice management strategies for your Clayoquot sites. In the meantime, we will complete the review of fish health records and this week's site visit so that we are in a position to move forward with our assessment once those details have been provided.

Thank you,
Melanie

Melanie McNabb
Governance Coordinator / Coordinatrice de la gouvernance
Fisheries and Oceans Canada, Pacific Region / Pêche et Océans Canada, région du pacifique
200 - 401 rue Burrard St, Vancouver, BC V6C 3S4
Tel. / tél (604) 666-6894
Fax / téléc (604) 666-1076
e-mail / courriel melanie.mcnabb@dfo-mpo.gc.ca

From: [REDACTED]
Sent: July-20-18 4:59 PM
To: salmonITC / CITsaumon (DFO/MPO)
Cc: [REDACTED] Manchester, Howie; Charbonneau, Michelle
Subject: *Confidential: Application for transfer of Smolts from Ocean Farms (#180) to Marine Facilities - Dixon (#234), Millar (#1507) & Ross (#526)

Hello,

Please find attached an applications for a licences to transfer fish from our Ocean Farms Hatchery to our marine facilities Dixon, Millar & Ross Pass (Clayoquot Region).

Should you have any questions please let me know.

Many Thanks,



CERMAQ

Phone +1 250-286-0022
Direct +1 250-286-0022 ext. [REDACTED]
Mobile [REDACTED]

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V9W 2C2 Campbell River, BC, Canada

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Manchester, Howie

From: Manchester, Howie
Sent: August-15-18 12:25 PM
To: Waddington, Zac
Subject: RE: Cermaq DFO Audits August 28-29

Okay, Kerra left for Tofino yesterday. I think they had a lot on their plate and I'm not sure what her (or crews) capacity for sea lice sampling is so I don't think it would be a good idea to arrange a sampling event with her crew.

I did ask her and she agreed to go on site and look into the pens and observe for moribund, lesions and lice levels from the surface. I also asked her to take pictures. I can also ask her to copy their last lice sampling information as well as SLICE treatment dates for us.

If you think its worth it I can try and arrange a targeted sea lice sampling for Friday or early next week.

Thanks

Howie

From: Waddington, Zac
Sent: August-14-18 5:43 PM
To: Manchester, Howie
Subject: RE: Cermaq DFO Audits August 28-29

I think if they are at the sites current being, or scheduled for SLICE treatment, it would be excellent to take a look in the pens and see what the state of affairs is. [REDACTED] due to the extreme Caligus burdens many of the fish had, and to my knowledge this is the first time that SLICE has been used to treat Caligus on a welfare basis?? Would you be able to ask Kerra and company what the availability would be to do that, and if they could line it up with a sea lice sampling event that would be excellent.

Zac

From: Manchester, Howie
Sent: August-14-18 12:12 PM
To: Waddington, Zac
Subject: RE: Cermaq DFO Audits August 28-29

Okay, we can talk more about this next week when you are back, also think about any other information/samples we may want to collect out of the ordinary from these sites during our audits (August 27 – 29). I assume that they would have done a bioassay with the caligus before SLICE usage?

Also Kerra's group is in Clayquot now doing some benthic sampling and asked if there was anything we would want them to collect or observe. I could not think of anything but let me know if you would like them to collect/review anything. I could ask them to observe the condition of some of the fish in the pens and report observations, maybe take some pictures for us at sites they are sampling at, I think they will be at Rant Point, Bare Bluff and Bawden. Let me know what you think.

Thanks

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Howie

From: Waddington, Zac
Sent: August-13-18 5:31 PM
To: Manchester, Howie
Subject: RE: Cermaq DFO Audits August 28-29

Thanks, I just had a chance to chat [REDACTED] about that and their EDR application. Apparently the rationale behind the SLICE rather than peroxide is welfare concerns [REDACTED] and water quality in the area. [REDACTED] thoughts were that either they would need to treat with SLICE, or cull on welfare grounds. Obviously he did not want to use SLICE again in Clayoquot, [REDACTED]
[REDACTED]
[REDACTED]

It's good that we know about this at least, though I really don't know what we can/should do to address this.....

Zac

From: Manchester, Howie
Sent: August-13-18 8:56 AM
To: Waddington, Zac
Subject: FW: Cermaq DFO Audits August 28-29

FYI. Apparently West Coast sites using SLICE for Caligus infestation.

Howie

From: [REDACTED]
Sent: August-10-18 12:38 PM
To: Manchester, Howie; Charbonneau, Michelle; Stenhouse, Shawn
Cc: [REDACTED]
Subject: Cermaq DFO Audits August 28-29

Hello

We may have to look at your DFO site audit schedule for August. Do to increase counts of Caligus at some West Coast sites that is causing fish welfare concerns we will be treating with Emamectin Benzoate (Slice) starting on August 13th, 2018. The sites that will be treated include Bedwell, Fortune and Bawden which you have scheduled for August 28th and 29th.

Just wanted to give you the heads up. Once I have more info on things I will let you know

Regards

s.19(1)
s.20(1)(b)
s.21(1)(b)

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Mobile [REDACTED]

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Manchester, Howie

From: Manchester, Howie
Sent: August-15-18 12:37 PM
To: Waddington, Zac
Subject: RE: Cermaq DFO Audits August 28-29

Hi Zac again,

I will actually try and arrange for myself to check out the fish at Fortune (that was the farm we were going to do a SL audit on August 29) on Friday, August 17th. I'll see if that can be arranged with Cermaq and Kerra's team.

Let me know what you think.

Howie

From: Waddington, Zac
Sent: August-14-18 5:43 PM
To: Manchester, Howie
Subject: RE: Cermaq DFO Audits August 28-29

I think if they are at the sites current being, or scheduled for SLICE treatment, it would be excellent to take a look in the pens and see what the state of affairs is. [REDACTED] due to the extreme Caligus burdens many of the fish had, and to my knowledge this is the first time that SLICE has been used to treat Caligus on a welfare basis?? Would you be able to ask Kerra and company what the availability would be to do that, and if they could line it up with a sea lice sampling event that would be excellent.

Zac

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To: Waddington, Zac
Subject: RE: Cermaq DFO Audits August 28-29

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Thanks

Howie

s.19(1)

s.20(1)(b)

From: Waddington, Zac
Sent: August-13-18 5:31 PM

To: Manchester, Howie

Subject: RE: Cermaq DFO Audits August 28-29

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It's good that we know about this at least, though I really don't know what we can/should do to address this....

Zac

From: Manchester, Howie

Sent: August-13-18 8:56 AM

To: Waddington, Zac

Subject: FW: Cermaq DFO Audits August 28-29

FYI. Apparently West Coast sites using SLICE for Caligus infestation.

Howie

From: [REDACTED]

Sent: August-10-18 12:38 PM

To: Manchester, Howie; Charbonneau, Michelle; Stenhouse, Shawn

Cc: [REDACTED]

Subject: Cermaq DFO Audits August 28-29

Hello

We may have to look at your DFO site audit schedule for August. Do to increase counts of Caligus at some West Coast sites that is causing fish welfare concerns we will be treating with Enamectin Benzoate (Slice) starting on August 13th, 2018. The sites that will be treated include Bedwell, Fortune and Bawden which you have scheduled for August 28th and 29th.

Just wanted to give you the heads up. Once I have more info on things I will let you know

Regards

CERMAQ

Phone +1 250-286-0022

Direct +1 250-286-0022 ext. [REDACTED]

Mobile [REDACTED]

Cermaq Canada Ltd.

#203-919 Island Hwy

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s.19(1)

s.20(1)(b)

s.21(1)(b)

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Manchester, Howie

From: Manchester, Howie
Sent: August-15-18 12:46 PM
To: Shaw, Kerra
Subject: Potential lice counts Friday

Hey Kerra,

I noticed from your schedule that you had some monitoring happening on Friday at Bare Bluff and then Bawden, what would be the chance of you guys dropping me off at Fortune before you go to Bawden so I can do some lice sampling in the morning? I'm just looking into this with the company, we are supposed to do sampling at Fortune on August 29th but it makes sense that I do this before the SLICE treatment they propose to do or may have just started. I can either come up Thursday night [REDACTED] or Friday morning if you are not leaving the dock too late (I can be in town by 8 or 8:30 am).

Also, at the sites you plan to visit in addition to pen observations (ie. Slow swimmers, any noted lesions or lice visible, floaters etc.) and pictures, can you also get a picture or copy of their latest 3 pens they have sampled for lice.

Let me know.

Thanks

Howie

Howie Manchester BSc
Senior Aquatic Science Biologist
Fisheries and Oceans Canada / Peches et Oceans Canada
Aquaculture Management Division / Gestion de l'aquaculture
Aquaculture Environmental Operations - Fish Health
#103 2435 Mansfield Drive
Courtenay, B.C
Telephone | Telephone: 250 703 0916 | Cell: [REDACTED]
Fax: 250 703 0921

s.16(2)(c)

s.19(1)

McNabb, Melanie

From: [REDACTED]
Sent: August-16-18 8.29 AM
To: Waddington, Zac
Cc: [REDACTED] Manchester, Howie; salmonITC / CITsaumon (DFO/MPO); [REDACTED]
Subject: *Confidential: RE: RE: ITC applications #S202 and S203 - ON HOLD
Attachments: 2018-29398_Conditions of release_IMVIXA_15AUG2018.pdf; 2018-29397_Conditions of release_IMVIXA_15AUG2018.pdf

Hello Zac,

We received the EDR for the Imvixa yesterday as hoped. Both Boot Lagoon and Ocean Farms Hatcheries will be commencing treatment of all fish scheduled for transport today.

Please find attached the EDR & associated conditions which include additional reporting to you.

Thanks



CERMAQ

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Mobile [REDACTED]

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V9W 2C2 Campbell River, BC, Canada

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From "Waddington, Zac" <Zac.Waddington@dfo-mpo.gc.ca>
To [REDACTED] "salmonITC / CITsaumon (DFO/MPO)" <SalmonITC@dfo-mpo.gc.ca>
Cc [REDACTED] "Manchester, Howie" <Howie.Manchester@dfo-mpo.gc.ca>
Date 14/08/2018 06:26 PM
Subject RE: *Confidential RE: ITC applications #S202 and S203 - ON HOLD

Thank you very much for providing that documentation of your planned stocking and lice mitigation activities in Tofino north. I have been in contact with the EDR department of Health Canada in order to try and expedite the approval process for Imvixa such that all smolts being restocked into Clayoquot would be able to be treated and thereby have efficacious lice mitigation prior to arrival of Cermaq's hydrolicer.

I am currently away from the office [REDACTED] but I would like to try and arrange a time to discuss the alternative mitigation strategies suggested by Cermaq if the EDR for Imvixa fails to come through in time. I will be available on Friday for a discussion, and by then we should know if the EDR has arrived in time for the Imvixa treatment to occur for all smolts to be transferred to Tofino north.

Zac

From: [REDACTED]
Sent: August-10-18 5:01 PM
To: salmonITC / CITsaumon (DFO/MPO)
Cc: [REDACTED] Manchester, Howie; Charbonneau, Michelle; [REDACTED] Waddington, Zac
Subject: *Confidential: RE: ITC applications #S202 and S203 - ON HOLD

Hello Zac,

Please find attached our Mitigation Plan for Sea Lice during the stocking of our Marine facilities in our Tofino North Operations.

Many Thanks,



CERMAQ

Phone +1 250-286-0022
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Mobile [REDACTED]

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V9W 2C2 Campbell River, BC, Canada

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From "salmonITC / CITsaumon (DFO/MPO)" <SalmonITC@dfo-mpo.gc.ca>
To [REDACTED], "salmonITC / CITsaumon (DFO/MPO)" <SalmonITC@dfo-mpo.gc.ca>
Cc [REDACTED] "Manchester, Howie" <Howie.Manchester@dfo-mpo.gc.ca>, "Charbonneau, Michelle" <Michelle.Charbonneau@dfo-mpo.gc.ca>, "Waddington, Zac" <Zac.Waddington@dfo-mpo.gc.ca>
Date 02/08/2018 03:14 PM
Subject RE: ITC applications #S202 and S203 - ON HOLD

Hello [REDACTED]

As discussed, we'll be putting these applications on hold pending further information on updated sea lice management strategies for your Clayoquot sites. In the meantime, we will complete the review of fish health records and this week's site visit so that we are in a position to move forward with our assessment once those details have been provided.

Thank you,
Melanie

s.19(1)

Melanie McNabb
Governance Coordinator / Coordinatrice de la gouvernance
Fisheries and Oceans Canada, Pacific Region / Pêche et Océans Canada, région du pacifique
200 - 401 rue Burrard St., Vancouver, BC V6C 3S4
Tel / tél (604) 666-6894
Fax / téléc (604) 666-1076
e-mail / courriel melanie.mcnabb@dfo-mpo.gc.ca

From: [REDACTED]
Sent: July-20-18 4:59 PM
To: salmonITC / CITsaumon (DFO/MPO)
Cc: [REDACTED] Manchester, Howie; Charbonneau, Michelle
Subject: *Confidential: Application for transfer of Smolts from Ocean Farms (#180) to Marine Facilities - Dixon (#234), Millar (#1507) & Ross (#526)

Hello,

Please find attached an applications for a licences to transfer fish from our Ocean Farms Hatchery to our marine facilities Dixon, Millar & Ross Pass (Clayoquot Region).

Should you have any questions please let me know.

Many Thanks,

[REDACTED]

CERMAQ

Phone +1 250-286-0022
Direct +1 250-286-0022 ext. [REDACTED]
Mobile [REDACTED]

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#203-919 Island Highway
V9W 2C2 Campbell River, BC, Canada

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**EMERGENCY DRUG RELEASE AUTHORIZATION /
AUTORISATION DE DISTRIBUTION DE MÉDICAMENTS D'URGENCE**

VETERINARY DRUGS DIRECTORATE / DIRECTION DES MÉDICAMENTS VÉTÉRINAIRES

Holland Cross Complex, Tower A, Ground Floor, Address Locator 3000A

14-11 Holland Avenue, Ottawa, ON K1A 0K9

Tel / Tél. 613 240-3916 Fax / Télécopieur 613 946-1125

hc.edr-dmu.sc@canada.ca

MANUFACTURER - SUPPLIER / FABRICANT - DISTRIBUTEUR Elanco Animal Health, Div. of Eli Lilly Canada Inc. Suite 120 Guelph, ONT, N1G 4T2, CAN		TEL/TÉL : [REDACTED] FAX/TÉLÉCOPIEUR : Use email CONTACT / PERSONNE RESSOURCE [REDACTED]
Pursuant to Section C 08 010 of the Food and Drugs Regulations, and notwithstanding Section C 08.002, the above-noted manufacturer is authorized to sell the following drug, in the quantity and under the conditions specified, to the veterinary practitioner named herein. / En vertu de l'article C.08.010 du Règlement sur les aliments et les drogues et nonobstant l'article C.08.002, le fabricant mentionné ci-dessus est autorisé à vendre le médicament suivant dans les quantités et selon les conditions spécifiées au vétérinaire nommé ci-dessous.		
DRUG BRAND NAME / NOM COMMERCIAL DU MÉDICAMENT IMVIXA 10%	ACTIVE INGREDIENT(S) / INGRÉDIENT(S) ACTIF(S) lufenuron	
QUANTITY / QUANTITÉ 30 kg		
DOSAGE / POSOLOGIE 5mg/kg biomass, orally administered in feed for seven days		
VETERINARY PRACTITIONER NAME & ADDRESS / NOM ET ADRESSE DU VÉTÉRINAIRE [REDACTED] Cermaq Canada 203-919 Island Hwy, Campbell River, BC, V9W 2C2		TEL/TÉL : 250-286-0022 FAX/TÉLÉCOPIEUR : 250-286-0042 EMAIL/COURRIEL : [REDACTED]
VETERINARY SITUATION, DISEASE, DIAGNOSIS / JUSTIFICATION DE L'UTILISATION, MALADIE, DIAGNOSTIC In-feed hatchery treatment. Prevention and control of sea lice infestations post marine transfer to Dixon Bay, Millar Channel and Bawden Point sites		
SPECIES / ESPÈCE(S) Atlantic Salmon / Saumon de l'Atlantique		
NUMBER OF ANIMALS, AGE, WEIGHT / NOMBRE D'ANIMAUX, ÂGE, POIDS 2019 SW, [REDACTED] avg weight 89g, total biomass [REDACTED] as per preliminary prescription dated 12July2018.		
ANIMAL PATIENT NAME AND OWNER'S NAME or PRODUCTION SITE AND PRODUCER'S NAME / NOM DE L'ANIMAL ET NOM DU PROPRIÉTAIRE ou SITE DE PRODUCTION ET NOM DU PRODUCTEUR Cermaq Canada Ltd Oceans Hatchery Pens TBD		
CONDITIONS It is understood that the efficacy, safety and quality of this new drug have not been evaluated by the Veterinary Drugs Directorate (VDD) and consequently, the veterinary practitioner assumes full responsibility for safety in the intended species and any drug residue related violations in food derived from treated animals. Treated fish must not be slaughtered for use in food for at least 350 days after the latest treatment with this drug. A representative sample of fish from each sea cage must be tested for drug residues and reported to the VDD prior to marketing for human consumption. Fish must not be transferred to sea cages until a minimum of 7 days after the treatment has ended. The VDD and the British Columbia DFO aquaculture authority, Zac Waddington, must be informed if the treated fish are moved to a sea cage site other than Dixon Bay, Millar Channel or Bawden Point. Serious adverse drug reactions must be reported to both the VDD and manufacturer within 15 days of suspected occurrence. All unused feed must be destroyed following treatment. Please see the attached letter for complete conditions of release.		
The above-named practitioner has complied with the requirements of Section C 08 010 of the Food and Drugs Regulations to obtain this drug for use according to his / her professional responsibility. In so doing, the practitioner has agreed to report to you and to the Veterinary Drugs Directorate, the results of this emergency use, including efficacy, safety in the intended species and any adverse reactions observed. These results must be submitted before any further authorization can be given. Pursuant to subsection C 08 011 (2) of the said Regulations, this sale is exempt from the provisions of the Food and Drugs Act and Regulations. / Le praticien nommé ci-dessus s'est conformé aux exigences de l'article C.08.010 du Règlement sur les aliments et les drogues afin de se procurer le médicament pour utilisation en accord avec ses responsabilités professionnelles. Ce faisant, le praticien a accepté de rendre compte, au fabricant et à la Direction des médicaments vétérinaires, des résultats de cette utilisation d'urgence, incluant l'efficacité, l'innocuité pour l'espèce visée et toute réaction indésirable observée. Ces résultats doivent être soumis avant que toute autre autorisation ne puisse être délivrée. En vertu du paragraphe C 08 011(2) de la Loi en question, cette vente n'est pas visée par les dispositions de Loi et du Règlement sur les aliments et drogues.		
EDR NO. / No DE DMU EDR 2018-29397		NON <input type="checkbox"/> FOOD <input checked="" type="checkbox"/>
VDD AUTHORITY SIGNATURE / SIGNATAIRE AUTORISÉ DE LA DMV : Dr. Julie Burke, Acting EDR Officer, DVM / Agente intérimaire d'autorisation de médicaments d'urgence <i>Julie Burke</i>		Date : 2018-08-15
02.11.22 PLEASE NOTE THIS FACSIMILE IS AN OFFICIAL AUTHORIZATION. IF YOU HAVE PROBLEMS WITH THIS AUTHORIZATION OR TRANSMISSION, PLEASE CONTACT THIS DIRECTORATE NOTE CE FACSIMILÉ CONSTITUE UNE AUTORISATION OFFICIELLE. SI VOUS ÉProuVEZ DES PROBLÈMES RELATIFS À CETTE AUTORISATION OU CETTE TRANSMISSION, VEUILLEZ CONTACTER LA DIRECTION DES MÉDICAMENTS VÉTÉRINAIRES.		

EDR CONDITIONS OF RELEASE: EDR 2018-29398

It is understood that the efficacy, safety and quality of this new drug have not been evaluated by the Veterinary Drugs Directorate (VDD) and consequently, the veterinary practitioner assumes full responsibility for safety in the intended species and any drug residue related violations in food derived from treated animals.

Treated fish must not be slaughtered for use in food for at least **350 days** after the latest treatment with this drug.

A representative sample of fish from each sea cage must be tested for drug residues and reported to the VDD prior to marketing for human consumption.

Fish must not be transferred to sea cages until a minimum of 7 days after the treatment has ended.

The VDD and the British Columbia - DFO aquaculture authority, Dr Zac Waddington, must be informed if the treated fish are moved to a sea cage site other than Dixon Bay, Millar Channel or Bawden Point.

Serious adverse drug reactions must be reported to both the VDD and manufacturer within 15 days of suspected occurrence.

All unused feed must be destroyed following treatment.

All unused drug must be returned to the manufacturer following treatment.

At the hatchery, do not feed excess diet containing lufenuron.

At the cages housing the treated fish, allow at least 1 year following treatment with lufenuron to allow natural systems to recover.

Furthermore:

1. This drug product may cause sensitisation by skin contact. Avoid direct contact with skin or eyes.
2. Operators mixing and handling the product should wear protective gloves, glasses and masks. Do not eat, drink or smoke when handling this product and medicated feed. Wash hands thoroughly with soap and water after handling. In case of accidental eye or skin contact, immediately rinse thoroughly with water. In case of accidental ingestion seek medical assistance immediately.
3. The lipophilic nature of lufenuron raises environmental concerns related specifically to the disposal of solid waste (feces and unconsumed feed) that will be produced during the hatchery portion of the production cycle. In order to prevent risk to the environment as a result of the use of Imvixa during the emergency drug release, it is recommended to minimize the release of waste water and solid waste from the Boot Lagoon Hatchery facilities to fish bearing waters and to follow provincial and municipal laws for the disposal of solid waste and waste water. Waste water and solid waste should

be collected, contained, and treated to prevent release to the environment. Solid waste and manure should be disposed of appropriately (e.g. biodigester, incinerator, or solid waste landfill). It is recommended to use a settling pond or lagoon to receive and contain any waste water.

4. Yearly benthic sampling should be collected and sent for drug residue analysis.
5. A follow-up report and answers to the following questions should be submitted to the VDD within 12 months of the Authorization Letter:

<ol style="list-style-type: none">1. Hatchery Site name:2. Number of salmon treated:3. Average weight of salmon treated:4. Dates (day/month/year) and total number of days medicated feed was offered:5. Quantity of IMVIXA used:6. Quantity of IMVIXA returned to Elanco:7. Fresh water phase:<ol style="list-style-type: none">a. Daily and/or weekly mortality during treatment and post-treatment prior to transferb. Comparison to industry average8. Transfer phase:<ol style="list-style-type: none">a. Mortality during transfer phaseb. Comparison to industry average9. Salt water phase:<ol style="list-style-type: none">a. Name of Marine Siteb. Daily and/or weekly mortality Up to and including 4 weeks post transferc. Comparison to industry average10. An estimation of the duration of activity, including sea lice counts for the site
--

Please note, that in June 2015 the Aquaculture Activities Regulations (AAR) of the Fisheries Act came into effect to manage potential impacts of fish pathogen and pest treatments (drugs and pesticides) to fish and fish habitat related to aquaculture activities. Part of this new regulatory regime includes a science-based research and advisory process to examine the feasibility, and need for risk-based post-deposit monitoring and remedial actions for drugs and pesticides including the implementation of environmental monitoring and/or environmental guidelines to address unacceptable risk. As a result, this substance may be subject to further regulatory requirements in the future.



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14-11 Holland Avenue, Ottawa, ON K1A 0K9

Tel. / Tél. : 613 240-3916 Fax / Télécopieur 613 946-1125

hc.edr-dmu.sc@canada.ca

MANUFACTURER - SUPPLIER / FABRICANT - DISTRIBUTEUR Elanco Animal Health, Div. of Eli Lilly Canada Inc. Suite 120 Guelph, ONT, N1G 4T2, CAN		TEL/TÉL : [REDACTED] FAX/TÉLÉCOPIEUR : Use email CONTACT / PERSONNE RESSOURCE [REDACTED]
Pursuant to Section C.08 010 of the Food and Drugs Regulations, and notwithstanding Section C.08.002, the above-noted manufacturer is authorized to sell the following drug, in the quantity and under the conditions specified, to the veterinary practitioner named herein. / En vertu de l'article C.08.010 du Règlement sur les aliments et les drogues et nonobstant l'article C.08 002, le fabricant mentionné ci-dessus est autorisé à vendre le médicament suivant dans les quantités et selon les conditions spécifiées au vétérinaire nommé ci-dessous.		
DRUG BRAND NAME / NOM COMMERCIAL DU MÉDICAMENT IMVIXA 10%		ACTIVE INGREDIENT(S) / INGRÉDIENT(S) ACTIF(S) lufenuron
QUANTITY / QUANTITÉ 30 kg /		
DOSAGE / POSOLOGIE 5mg/kg biomass, orally administered in feed for seven days.		
VETERINARY PRACTITIONER NAME & ADDRESS / NOM ET ADRESSE DU VÉTÉRINAIRE [REDACTED] Cermaq Canada 203-919 Island Hwy, Campbell River, BC, V9W 2C2		TEL/TÉL : 250-286-0022 FAX/TÉLÉCOPIEUR : 250-286-0042 EMAIL/COURRIEL : [REDACTED]
VETERINARY SITUATION, DISEASE, DIAGNOSIS / JUSTIFICATION DE L'UTILISATION, MALADIE, DIAGNOSTIC In-feed hatchery treatment. Prevention and control of sea lice infestations post marine transfer to Dixon Bay, Millar Channel and Bawden Point sites		
SPECIES / ESPÈCE(S) Atlantic Salmon / Saumon de l'Atlantique		
NUMBER OF ANIMALS, AGE, WEIGHT / NOMBRE D'ANIMAUX, ÂGE, POIDS 2019 SW, [REDACTED] avg weight 88 g, total biomass [REDACTED] as per preliminary prescription dated 12July2018.		
ANIMAL PATIENT NAME AND OWNER'S NAME or PRODUCTION SITE AND PRODUCER'S NAME / NOM DE L'ANIMAL ET NOM DU PROPRIÉTAIRE ou SITE DE PRODUCTION ET NOM DU PRODUCTEUR Cermaq Canada Ltd. Boot Lagoon Hatchery Pens TBD		
CONDITIONS It is understood that the efficacy, safety and quality of this new drug have not been evaluated by the Veterinary Drugs Directorate (VDD) and consequently, the veterinary practitioner assumes full responsibility for safety in the intended species and any drug residue related violations in food derived from treated animals. Treated fish must not be slaughtered for use in food for at least 350 days after the latest treatment with this drug. A representative sample of fish from each sea cage must be tested for drug residues and reported to the VDD prior to marketing for human consumption. Fish must not be transferred to sea cages until a minimum of 7 days after the treatment has ended. The VDD and the British Columbia provincial aquaculture authority, Zac Waddington, must be informed if the treated fish are moved to a sea cage site other than Dixon Bay, Millar Channel or Bawden Point. Serious adverse drug reactions must be reported to both the VDD and manufacturer within 15 days of suspected occurrence. All unused feed must be destroyed following treatment. Please see the attached letter for complete conditions of release.		
The above-named practitioner has complied with the requirements of Section C 08.010 of the Food and Drugs Regulations to obtain this drug for use according to his / her professional responsibility. In so doing, the practitioner has agreed to report to you and to the Veterinary Drugs Directorate, the results of this emergency use, including efficacy, safety in the intended species and any adverse reactions observed. These results must be submitted before any further authorization can be given. Pursuant to subsection C 08 011 (2) of the said Regulations, this sale is exempt from the provisions of the Food and Drugs Act and Regulations. / Le praticien nommé ci-dessus s'est conformé aux exigences de l'article C 08 010 du Règlement sur les aliments et les drogues afin de se procurer le médicament pour utilisation en accord avec ses responsabilités professionnelles. Ce faisant, le praticien a accepté de rendre compte, au fabricant et à la Direction des médicaments vétérinaires, des résultats de cette utilisation d'urgence, incluant l'efficacité, l'innocuité pour l'espèce visée et toute réaction indésirable observée. Ces résultats doivent être soumis avant que toute autre autorisation ne puisse être délivrée. En vertu du paragraphe C.08 011(2) de la Loi en question, cette vente n'est pas visée par les dispositions de Loi et du Règlement sur les aliments et drogues.		
EDR NO. / No DE DMU EDR 2018-29398		NON <input type="checkbox"/> FOOD <input checked="" type="checkbox"/>
VDD AUTHORITY SIGNATURE / SIGNATAIRE AUTORISÉ DE LA DMV : Dr. Julie Burke, Acting EDR Officer, DVM / Agente intérimaire d'autorisation de médicaments d'urgence		Date : 2018-08-15
02.11.22 PLEASE NOTE THIS FACSIMILE IS AN OFFICIAL AUTHORIZATION. IF YOU HAVE PROBLEMS WITH THIS AUTHORIZATION OR TRANSMISSION, PLEASE CONTACT THIS DIRECTORATE NOTE CE FACSIMILÉ CONSTITUE UNE AUTORISATION OFFICIELLE. SI VOUS ÉPROUVEZ DES PROBLÈMES RELATIFS À CETTE AUTORISATION OU CETTE TRANSMISSION, VEUILLEZ CONTACTER LA DIRECTION DES MÉDICAMENTS VÉTÉRINAIRES		

s.19(1)

s.20(1)(b)

000970

EDR CONDITIONS OF RELEASE: EDR 2018-23297

It is understood that the efficacy, safety and quality of this new drug have not been evaluated by the Veterinary Drugs Directorate (VDD) and consequently, the veterinary practitioner assumes full responsibility for safety in the intended species and any drug residue related violations in food derived from treated animals.

Treated fish must not be slaughtered for use in food for at least **350 days** after the latest treatment with this drug.

A representative sample of fish from each sea cage must be tested for drug residues and reported to the VDD prior to marketing for human consumption.

Fish must not be transferred to sea cages until a minimum of 7 days after the treatment has ended.

The VDD and the British Columbia - DFO aquaculture authority, Dr Zac Waddington, must be informed if the treated fish are moved to a sea cage site other than Dixon Bay, Millar Channel or Bawden Point.

Serious adverse drug reactions must be reported to both the VDD and manufacturer within 15 days of suspected occurrence.

All unused feed must be destroyed following treatment.

All unused drug must be returned to the manufacturer following treatment.

At the hatchery, do not feed excess diet containing lufenuron.

At the cages housing the treated fish, allow at least 1 year following treatment with lufenuron to allow natural systems to recover.

Furthermore:

1. This drug product may cause sensitisation by skin contact. Avoid direct contact with skin or eyes.
2. Operators mixing and handling the product should wear protective gloves, glasses and masks. Do not eat, drink or smoke when handling this product and medicated feed. Wash hands thoroughly with soap and water after handling. In case of accidental eye or skin contact, immediately rinse thoroughly with water. In case of accidental ingestion seek medical assistance immediately.
3. The lipophilic nature of lufenuron raises environmental concerns related specifically to the disposal of solid waste (feces and unconsumed feed) that will be produced during the hatchery portion of the production cycle. In order to prevent risk to the environment as a result of the use of Imvixa during the emergency drug release, it is recommended to minimize the release of waste water and solid waste from the Oceans Hatchery facilities to fish bearing waters and to follow provincial and municipal laws for the disposal of solid waste and waste water. Waste water and solid waste should

be collected, contained, and treated to prevent release to the environment. Solid waste and manure should be disposed of appropriately (e.g. biodigester, incinerator, or solid waste landfill). It is recommended to use a settling pond or lagoon to receive and contain any waste water.

4. Yearly benthic sampling should be collected and sent for drug residue analysis.
5. A follow-up report and answers to the following questions should be submitted to the VDD within 12 months of the Authorization Letter:

1. Hatchery Site name:
2. Number of salmon treated:
3. Average weight of salmon treated:
4. Dates (day/month/year) and total number of days medicated feed was offered:
5. Quantity of IMVIXA used:
6. Quantity of IMVIXA returned to Elanco:
7. Fresh water phase:
 - a. Daily and/or weekly mortality during treatment and post-treatment prior to transfer
 - b. Comparison to industry average
8. Transfer phase:
 - a. Mortality during transfer phase
 - b. Comparison to industry average
9. Salt water phase:
 - a. Name of Marine Site
 - b. Daily and/or weekly mortality Up to and including 4 weeks post transfer
 - c. Comparison to industry average
10. An estimation of the duration of activity, including sea lice counts for the site

Please note, that in June 2015 the Aquaculture Activities Regulations (AAR) of the Fisheries Act came into effect to manage potential impacts of fish pathogen and pest treatments (drugs and pesticides) to fish and fish habitat related to aquaculture activities. Part of this new regulatory regime includes a science-based research and advisory process to examine the feasibility, and need for risk-based post-deposit monitoring and remedial actions for drugs and pesticides including the implementation of environmental monitoring and/or environmental guidelines to address unacceptable risk. As a result, this substance may be subject to further regulatory requirements in the future.

McNabb, Melanie

From: Waddington, Zac
Sent: August-16-18 10:58 AM
To: [REDACTED]
Cc: [REDACTED] Manchester, Howie; salmonITC / CITsaumon (DFO/MPO); [REDACTED]
Subject: RE: *Confidential: RE: RE: ITC applications #S202 and S203 - ON HOLD

Very glad to hear this was able to arrive in time for the treatment to occur. I view the use of this product as sufficient mitigation for sea lice concerns and will review the transfer applications in detail and expect to have a recommendation for the ITC very shortly.

Dr Zac Waddington DVM, B.Env.Sc.(Hons)
Lead Veterinarian - Pacific Region
Fisheries and Oceans Canada | Pêches et Océans Canada
Aquaculture Environmental Operations - Fish Health
Courtenay, British Columbia
Telephone | Téléphone: 250-703-0902
Fax | Télécopieur. 250-703-0921
Zac.Waddington@dfo-mpo.gc.ca

From: [REDACTED]
Sent: August-16-18 8:29 AM
To: Waddington, Zac
Cc: [REDACTED] Manchester, Howie; salmonITC / CITsaumon (DFO/MPO); [REDACTED]
Subject: *Confidential: RE: RE: ITC applications #S202 and S203 - ON HOLD

Hello Zac,

We received the EDR for the Imvixa yesterday as hoped. Both Boot Lagoon and Ocean Farms Hatcheries will be commencing treatment of all fish scheduled for transport today.

Please find attached the EDR & associated conditions which include additional reporting to you.

Thanks



CERMAQ

Phone +1 250-286-0022
Direct +1 250-286-0022 ext. [REDACTED]
Mobile [REDACTED]

s.19(1)

Cermaq Canada Ltd.
#203-919 Island Highway
V9W 2C2 Campbell River, BC, Canada

Cermaq.ca [Facebook](#) [Twitter](#)

From "Waddington, Zac" <Zac.Waddington@dfo-mpo.gc.ca>
To "salmonITC / CITsaumon (DFO/MPO)" <SalmonITC@dfo-mpo.gc.ca>
Cc "Manchester, Howie" <Howie.Manchester@dfo-mpo.gc.ca>
Date 14/08/2018 06:26 PM
Subject RE: *Confidential RE: ITC applications #S202 and S203 - ON HOLD

Thank you very much for providing that documentation of your planned stocking and lice mitigation activities in Tofino north. I have been in contact with the EDR department of Health Canada in order to try and expedite the approval process for Imvixa such that all smolts being restocked into Clayoquot would be able to be treated and thereby have efficacious lice mitigation prior to arrival of Cermaq's hydrolicer

I am currently away from the office [REDACTED] but I would like to try and arrange a time to discuss the alternative mitigation strategies suggested by Cermaq if the EDR for Imvixa fails to come through in time. I will be available on Friday for a discussion, and by then we should know if the EDR has arrived in time for the Imvixa treatment to occur for all smolts to be transferred to Tofino north.

Zac

From: [REDACTED]
Sent: August-10-18 5:01 PM
To: salmonITC / CITsaumon (DFO/MPO)
Cc: [REDACTED] Manchester, Howie; Charbonneau, Michelle; [REDACTED] Waddington, Zac
Subject: *Confidential: RE: ITC applications #S202 and S203 - ON HOLD

Hello Zac,

Please find attached our Mitigation Plan for Sea Lice during the stocking of our Marine facilities in our Tofino North Operations.

Many Thanks,

[REDACTED]

CERMAQ

Phone +1 250-286-0022
Direct +1 250-286-0022 ext. [REDACTED]
Mobile + [REDACTED]

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#203-919 Island Highway
V9W 2C2 Campbell River, BC, Canada

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From "salmonITC / CITsaumon (DFO/MPO)" <SalmonITC@dfo-mpo.gc.ca>
To [REDACTED], "salmonITC / CITsaumon (DFO/MPO)" <SalmonITC@dfo-mpo.gc.ca>
Cc [REDACTED], "Manchester, Howie" <Howie.Manchester@dfo-mpo.gc.ca>,
"Charbonneau, Michelle" <Michelle.Charbonneau@dfo-mpo.gc.ca>, "Waddington, Zac" <Zac.Waddington@dfo-mpo.gc.ca>
Date 02/08/2018 03:14 PM
Subject RE ITC applications #S202 and S203 - ON HOLD

Hello [REDACTED]

As discussed, we'll be putting these applications on hold pending further information on updated sea lice management strategies for your Clayoquot sites. In the meantime, we will complete the review of fish health records and this week's site visit so that we are in a position to move forward with our assessment once those details have been provided.

Thank you,
Melanie

Melanie McNabb
Governance Coordinator / Coordinatrice de la gouvernance
Fisheries and Oceans Canada, Pacific Region / Pêche et Océans Canada, région du pacifique
200 - 401 rue Burrard St, Vancouver, BC V6C 3S4
Tel / tél.: (604) 666-6894
Fax / téléc.: (604) 666-1076
e-mail / courriel melanie.mcnabb@dfo-mpo.gc.ca

From: [REDACTED]
Sent: July-20-18 4:59 PM
To: salmonITC / CITsaumon (DFO/MPO)
Cc: [REDACTED], Manchester, Howie; Charbonneau, Michelle
Subject: *Confidential: Application for transfer of Smolts from Ocean Farms (#180) to Marine Facilities - Dixon (#234), Millar (#1507) & Ross (#526)

Hello,

Please find attached an applications for a licences to transfer fish from our Ocean Farms Hatchery to our marine facilities Dixon, Millar & Ross Pass (Clayoquot Region).

Should you have any questions please let me know.

Many Thanks,



CERMAQ

Phone +1 250-286-0022
Direct +1 250-286-0022 ext. [REDACTED]
Mobile [REDACTED]

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Sandberg, Krista

From: Sandberg, Krista
Sent: August-16-18 3:28 PM
To: Manchester, Howie
Subject: RE: Marsh Bay - Lice numbers

I will be done AQUIS testing tomorrow, then Report E Monday. I can probably have June and July by the end of next week.

Krista Sandberg

Office | Bureau 250-286-5835

Cellular | Cellulaire [REDACTED]



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Gouvernement
du Canada

Canada

From: Manchester, Howie
Sent: August-16-18 3:24 PM
To: Sandberg, Krista
Subject: RE: Marsh Bay - Lice numbers

Yes, I did thanks,

I was just wondering if we had May – July 2018, mostly since we don't have a lot a data point to base a decision on, so every little bit helps. I'll have to see when Zac had a chance to look at this but probably won't be till end of next week or even later. When do you think you would have June and July done, i can always just look at the sea lice submissions for those months.

Thanks

Howie

From: Sandberg, Krista
Sent: August-16-18 2:17 PM
To: Manchester, Howie
Subject: RE: Marsh Bay - Lice numbers

Did you not get the summary that I included in the email to everybody?

I'm behind on sea lice but I do have May done and they were only at 0.18

Krista Sandberg

Office | Bureau 250-286-5835

Cellular | Cellulaire [REDACTED]



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Canada

From: Manchester, Howie
Sent: August-16-18 2:13 PM
To: Sandberg, Krista

s.16(2)(c)

Cc: Waddington, Zac
Subject: RE: Marsh Bay - Lice numbers

Hey,

I was just hoping that there was an easy way for you to summarize the monthly lice counts from January 2017 to present (I had already looked from 2014 to 2016), indicating any treatments and highlighting over - threshold.

I do recall now that they were fallow for a while in 2017, therefore making assessing their ability to properly deal with lice difficult.

Do we only have data to April 2018?

Thanks
Howie

From: Sandberg, Krista
Sent: August-16-18 2:02 PM
To: Manchester, Howie
Subject: RE: Marsh Bay - Lice numbers

Hey Howie,

I replied to the other email before I saw this one. The actions taken can be found in the sea lice compliance tracking. They treated with Slice in March 2016 and the Oct/Nov exceedances were at the end of the production cycle so they just harvested out.

Krista Sandberg

Office | Bureau 250-286-5835
Cellular | Cellulaire [REDACTED]



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du Canada

Canada

From: Manchester, Howie
Sent: August-16-18 12:39 PM
To: Sandberg, Krista
Cc: Waddington, Zac
Subject: Marsh Bay - Lice numbers

Hi Krista,

Would you please be able to provide sea lice data for Marsh Bay from 2017 and 2018 indicating their lice abundance levels from monthly industry reports, fish health audits or over threshold notification. We want to see if during this time this site was over threshold and if so which months and what was the resolution if any.

Thanks


s.16(2)(c)

Howie

Howie Manchester BSc
Senior Aquatic Science Biologist
Fisheries and Oceans Canada / Pêches et Océans Canada
Aquaculture Management Division / Gestion de l'aquaculture
Aquaculture Environmental Operations - Fish Health

#103 2435 Mansfield Drive

Courtenay, B.C

Telephone | Telephone: 250 703 0916 | Cell: 

Fax: 250 703 0921

s.16(2)(c)

No further information has been removed or severed from this page

Jones, Simon

From: Shaw, Kerra
Sent: Monday, August 20, 2018 12:34 PM
To: Waddington, Zac; Jones, Simon
Cc: Paylor, Adrienne
Subject: RE: Sea lice management and resistance in Clayoquot Sound

Follow Up Flag: Follow up
Flag Status: Completed

Categories: Yellow Category

I did not tackle this while you were away, Zac. So I'd assume no one from aquaculture management has responded.

Kerra

From: Waddington, Zac
Sent: Tuesday, August 14, 2018 5:10 PM
To: Jones, Simon; Shaw, Kerra
Cc: Paylor, Adrienne
Subject: RE: Sea lice management and resistance in Clayoquot Sound

Was anyone able to get back to this request? It's virtually a "yes" to all the questions posed. If no one has responded I'm happy to give him a shout.

Zac

From: Jones, Simon
Sent: August-07-18 11:05 AM
To: Shaw, Kerra
Cc: Waddington, Zac; Paylor, Adrienne
Subject: FW: Sea lice management and resistance in Clayoquot Sound

Hi Kerra,

Just saw the out of office from Zac and Adrienne.

Cheers, Simon

From: Jones, Simon
Sent: August-07-18 11:04 AM
To: Waddington, Zac
Cc: Paylor, Adrienne
Subject: FW: Sea lice management and resistance in Clayoquot Sound

s.19(1)

Hi Zac,

I haven't seen recent bio-assay data from farms in Clayoquot Sd, and cannot provide [REDACTED] an informed answer to his question.

In any event, your shop will likely have additional information to address this question.

Let me know if you require my input.

Best, Simon

Simon R.M. Jones
Acting Section Head AAH

*Aquatic Animal Health Section
Pacific Biological Station
Fisheries and Oceans Canada
3190 Hammond Bay Road
Nanaimo, British Columbia
V9T 6N7, Canada*

Tel: 250 729 8351
Fax: 250 756 7053
E-mail: simon.jones@dfo-mpo.gc.ca

From: [REDACTED]
Sent: August-06-18 1:34 PM
To: Jones, Simon
Subject: Sea lice management and resistance in Clayoquot Sound

Hi Simon,

My name is [REDACTED] the Cedar Coast Field Station, situated on Vargas Island here in Clayoquot Sound. This spring we were conducting juvenile salmon and sealice monitoring during the juvenile salmon out migration. The outbreak seen on farms in Clayoquot Sound this year also seemed to coincided with high abundance and prevalence of sea lice on the wild fry and smolts we were assessing in the region. We had a small survey this year but the fish we did find had lice loads much higher than was reported for juvenile salmon in the region during previous assessments.

There has been lots of talk about the use of hydrogen peroxide to treat sea lice on the Cermaq farms here, including discussing resistance to slice developing. I have heard lots of rumblings and rumours mentioning resistance developing but I have not heard anything from an official source. It is mentioned in one of Cermaq's permit applications for use of hydrogen peroxide around Campbell river, but they do not mention the location in which slice resistance lice were found. Is there any concrete evidence of slice resistance forming in BC or is the treatment with hydrogen peroxide here in Clayoquot Sound an attempt to reduce the potential for resistance by using an array of treatments?

All the best,

[REDACTED]
s.19(1)

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s.19(1)

Cedar Coast Field Station

No further information has been removed or severed from this page

Waddington, Zac

From: Waddington, Zac
Sent: August-27-18 10:42 AM
To: Doucette, Claire
Subject: RE: Status update

Thanks very much, I'll wait to hear from you.

Zac

From: Doucette, Claire
Sent: August-27-18 7:03 AM
To: Waddington, Zac
Subject: RE: Status update

Zac, I should have an answer for you this week on this matter – standby.

Claire

From: Waddington, Zac
Sent: Friday, August 24, 2018 3:39 PM
To: Doucette, Claire <Claire.Doucette@dfo-mpo.gc.ca>
Subject: Status update

Hello again,

I was curious if there was any update on C and P's progress regarding the licence non-compliance with some of the sites in Clayoquot during the spring outmigration in 2018. [REDACTED]

Dr. Zac Waddington DVM, B.Env.Sc.(Hons)
Lead Veterinarian - Pacific Region
Fisheries and Oceans Canada | Pêches et Océans Canada
Aquaculture Environmental Operations - Fish Health
Courtenay, British Columbia
Telephone | Téléphone: 250-703-0902
Fax | Télécopieur: 250-703-0921
Zac.Waddington@dfo-mpo.gc.ca

s.21(1)(a)

s.21(1)(b)

Waddington, Zac

From: Waddington, Zac
Sent: August-30-18 9:02 AM
To: Paylor, Adrienne
Subject: RE: Bioassay report for Bawden

Yes that make sense. [REDACTED] does not represent Ahousat, but does have some relationships with them. I'll let him know we will get back to him.

Zac

From: Paylor, Adrienne
Sent: August-29-18 5:22 PM
To: Waddington, Zac
Subject: Fw: Bioassay report for Bawden

I'm checking with Allison on this and it just dawned on me that we should also check with C&P in case the report becomes part of a court brief at some point.
A

Sent from my BlackBerry 10 smartphone on the Rogers network.

From: Paylor, Adrienne <Adrienne.Paylor@dfo-mpo.gc.ca>
Sent: Wednesday, August 29, 2018 5:18 PM
To: Webb, Allison
Subject: Re: Bioassay report for Bawden

Oh just thought this might become part of an investigation so perhaps we should hold off sharing?

Sent from my BlackBerry 10 smartphone on the Rogers network.

From: Paylor, Adrienne
Sent: Wednesday, August 29, 2018 4:12 PM
To: Webb, Allison
Subject: Fw: Bioassay report for Bawden

I'm inclined to share the results with Ahousat but not sure if [REDACTED] represents them or not? Should we discuss before we start sharing one off lab results based on individual requests?

Sent from my BlackBerry 10 smartphone on the Rogers network.

From: Waddington, Zac <Zac.Waddington@dfo-mpo.gc.ca>
Sent: Wednesday, August 29, 2018 3:24 PM
To: Paylor, Adrienne
Subject: FW: Bioassay report for Bawden

s.19(1)

I responded to an information request by a guy named [REDACTED] from an organization in the Tofino area called the Cedar Coast Field Station, which is located on Vargus Island just north of Tofino. We chatted on the phone yesterday, [REDACTED] and I spoke with him about the lice situation in Clayoquot, and what measures were being taken by us and Cermaq to ensure it did not happen again. He mentioned that they (and Ahousat) have been asking Cermaq to share their bioassay results with them, but thus far had not had any response from Cermaq. I did mention that we've done our own bioassay, and now today he's come back and asked to see any bioassay data available. I think that we could and should share our own bioassay (see attached), which is publicly funded through us anyway. Would you have issue with that? I did say that I cannot share industry data which has been shared with me in confidence.

Zac

From: Keith, Ian
Sent: June-04-18 1:50 PM
To: Waddington, Zac
Subject: FW: Bioassay report for Bawden

Hi Zac,

Here are the Bawden bioassay results, which appear similar to 2018 Rant, Saranac and Ross ie adult females more resistant than adult males and pre-adults. The re-fresh as Howie calls it, the genetic influence from wild fish lice, are seen in the adult males and the pre-adults, but the adult females are the old genetics.
(Normally post treatment of wild lice, we see adult males has more resistant. My working hypothesis is that there are inducible resistance mechanisms, for example, inducible enzymes.)

Ian

From: [REDACTED]
Sent: June-04-18 1:00 PM
To: Keith, Ian
Cc: [REDACTED]
Subject: Bioassay report for Bawden

Hi Ian

I have completed the report for the Bioassay done for Bawden sea lice.

We had lot of lice so I increased the replicates to 4 per male and female and managed to get 2 trays of pre-adult females. I did a Probit for the 2 replicates of pre-females just to get an idea of what their levels were.

Please feel free to contact me if you have any questions.

Cheers,

s.19(1)

[REDACTED]

BC Centre for Aquatic Health Sciences
Street Address: 871A Island Hwy, Campbell River, BC
Mailing Address: PO Box 25070 Tyee, Campbell River, BC, Canada V9W 0B7
ph: 250 286-6102 f: 250 286-6103
email: [REDACTED]
web: www.caahs-bc.ca

Manchester, Howie

From: Manchester, Howie
Sent: September-05-18 11:01 AM
To: Paylor, Adrienne
Subject: FW: West Coast sea lice summary

Hi Adrienne,

Here is a summary I sent Zac on August 21 updating sea lice on the west coast fish farms.

Howie

From: Manchester, Howie
Sent: August-21-18 3:47 PM
To: Waddington, Zac
Subject: West Coast sea lice summary

Hi Zac,

Please see the word and excel files within the link below.

I summarized the industry monthly submitted sea lice numbers (April to July 2018) for each site and indicated where treatments were done or pending. The word document contains point form summary of what we know about treatments, harvest, stocking plans for each site, I did not have any bioassay information for the farms to be treated with SLICE for either Grieg or Cermaq (I've highlighted this in yellow).

[\\Dcbcvanna01b\VAN_RHQ_4\Aqua\AEO\Courtenay\FH\sea lice management\West Coast SL summer 2018](#)

Have a look through and let me know If you would like me to add or modify.

Hopefully this is helpful to give Allison a synopsis of the sea lice situation on the west coast of Vancouver Island.

Howie

Claquot Cermaq Sites sea lice status (April – present)

Bare Bluff

- Site reached over threshold in late May 2018
- Peroxide done June 7 – 10
- Slice started – August 16 – reason indicated (pers. Comm. from Cermaq vet) is welfare issues due to a Caligus infestation, a FHE was submitted for this treatment.
July 2018 industry sea lice report indicated no Caligus or chalimus issues.
- Latest Bioassays result–

Bawden

- Slice done February 2018
- Peroxide done June 11 – 14, 2018
- Harvested to be completed August 28, 2018

Bedwell

- Peroxide done July 7 – 10, 2018
- Slice started – August 18, 2018 - reason indicated (pers. Comm. from Cermaq vet) is welfare issues due to Caligus infestation, a FHE was submitted for this treatment.
- July 2018 industry sea lice report indicated no Caligus issues but high chalimus counts.
- Latest Bioassay result–

Dixon

- 2018 generation harvested out May 2018
- New fish (2019 generation) scheduled to enter from Boot Lagoon and Oceans hatchery starting August 29, 2018
- Company has provided a SL management plan for the new entries including treating fish with a drug in freshwater that will prevent sea lice infection for up to 9 months in sea water.

Fortune

- Peroxide done July 8 – 11, 2018
- Slice started – August 15, 2018 - reason indicated (pers. Comm. from Cermaq vet) is welfare issues due to a Caligus infestation, a FHE was submitted for this treatment.
- July 2018 industry sea lice report indicated low level Caligus but high chalimus counts.
- Latest Bioassay result–

Millar

- 2018 generation harvested out March 2018

- New fish (2019 generation) predicted to enter from Boot Lagoon and Oceans hatchery in October 2018.
- Company has provided a SL management plan for the new entries including treating fish with a drug in freshwater that will prevent sea lice infection for up to 9 months in sea water.

Mussel Rock

- 2018 generation harvested out June 2018
- No plans submitted to re stock in 2018

Plover

- Peroxide done June 7 – 10, 2018
- Slice started – August 18, 2018 - reason indicated (pers. Comm. from Cermaq vet) is welfare issues due to a Caligus infestation, a FHE was submitted for this treatment.
- July industry sea lice report indicated low level Caligus and chalimus counts.
- Bioassay – Latest bioassay result -

Rant Point

- Some harvesting in July and August 2018
- Peroxide was scheduled for May 2018, no indication that this was completed. We will check while on site next week (August 28th)

Ross Pass

- 2018 generation harvested out April 2018
- 2019 generation predicted to be stocked from Boot Lagoon and Oceans October 2018
- Company has provided a SL management plan for the new entries including treating fish with a drug in freshwater that will prevent sea lice infection for up to 9 months in sea water.

Saranac

- 2018 generation harvested out June 2018
- 2019 generation predicted to be stocked November 2018, no indication of source hatchery.

Esperanza & Nootka Sites Sea lice status (April – present)

Atrevida

- Harvested out in April 2018
- No forecast to re-stock in 2018

Concepcion

- Harvested out in June 2018
- Forecast to re-stock in October 2018

Esperanza

- Fish in from Hecate and Steamer in May 2018
- SLICE treatment pending for July and August, not able to feed out due to plankton.
- Bioassay results –

Gore

- Some peroxide treatments in March and May
- Harvested out in June.
- Forecast to re-stock in December 2018

Hecate

- SLICE treatment pending for July and August, not able to feed out due to plankton.
- Bioassay results –

Muchalat North

- Harvested out in April 2018
- Forecast to re-stock in September 2018

Muchalat South

- Harvested out in June 2018
- No plans to re-stock in 2018

Steamer Point

- SLICE treatment pending for July and August, not able to feed out due to plankton.
- Bioassay results –

Quatsino Sites Sea lice status (April – present)

- No sea lice issues noted on any of the Quatsino sites since April 2018.
- No treatments notes since then, this area has been fallow since June 2018.
- Re stocking to begin in October 2018

Bare Bluff			April		May		June		July		August
Sample Date	Pen	Mottle L. salmonis - Average per fish for area	Sample Date	Pen	Mottle L. salmonis - Average per fish for area	Sampling Event Start Date	Pen	Mottle L. salmonis - Average per fish for area	Sampling Event Start Date	Pen ID	Mottle L. salmonis - Average per fish for area
01/04/2018	105	0.5	10-May-18	101	2.3	06/06/2018	101	3.1	17/07/2018	104	2.6
01/04/2018	103	0.2	16-May-18	104	0.6	13/06/2018	106	6.0	10/07/2018	101	0.6
11/04/2018	106	0.8	16-May-18	102	1.8	13/06/2018	104	2.7	16/07/2018	103	1.3
11/04/2018	102	0.4	24-May-18	101	2.1	25/06/2018	103	4.9	05/07/2018	103	1.7
15/04/2018	101	0.7	29-May-18	105	6.0	26/06/2018	101	2.9	19/07/2018	106	4.7
26/04/2018	101	1.5	29-May-18	101	4.4	28/06/2018	102	0.3	10/07/2018	102	0.6
29/04/2018	103	1.4				28/06/2018	101	0.1			
29/04/2018	102	1.3				28/06/2018	104	3.5			
						29/06/2018	102	0.9			
						29/06/2018	106	6.3			
						29/06/2018	105	4.6			
						29/06/2018	104	0.5			
						30/06/2018	106	0.6			
Bawden			April		May		June		July		August
01/04/2018	101	9.1	9-May-18	106	28.1	12/06/2018	103pre	54.7	18/07/2018	104	36.1
11/04/2018	103	10.1	9-May-18	104	29.4	13/06/2018	103pre	7.8	22/07/2018	102	17.9
12/04/2018	104	9.6	13-May-18	101	15.7	13/06/2018	103pst-a	6.6	11/07/2018	102	29.9
15/04/2018	101	7.3	23-May-18	103	38.3	13/06/2018	103pst-b	4.8	18/07/2018	106	29.9
25/04/2018	102	17.6	23-May-18	105	35.7	14/06/2018	106pre	48.8			
25/04/2018	105	20.1	27-May-18	101	21.1	14/06/2018	103pst	3.6			
29/04/2018	101	9.9				15/06/2018	105pre	3.9			
						17/06/2018	105pst	3.4			
						17/06/2018	104pre	52.2			
						18/06/2018	102pre	53.3			
						18/06/2018	106pst-a	4.5			
						18/06/2018	106pst-b	3.6			
						18/06/2018	106pst-c	3.9			
						19/06/2018	106pst	4.2			
						19/06/2018	104pst	2.9			
						20/06/2018	101pre	46.2			
						20/06/2018	104pst	4.6			
						21/06/2018	104pst-a	5.0			
						21/06/2018	104pst-b	3.5			
						22/06/2018	102pst-a	4.0			
						22/06/2018	102pst-b	3.1			
						24/06/2018	102pst	3.6			
Bedwell			April		May		June		July		August
14/04/2018	105	1.2	12-May-18	109	2.0	09/06/2018	101	7.9	03/07/2018	108	10.1
15/04/2018	103	1.5	13-May-18	101	5.1	12/06/2018	101	5.0	04/07/2018	110	10.8
16/04/2018	101	2.6	14-May-18	105	0.8	12/06/2018	102	5.6	04/07/2018	107	19.1
28/04/2018	101	3.0	26-May-18	101	3.8	23/06/2018	101	11.0	18/07/2018	102	1.2
29/04/2018	104	2.2	27-May-18	103	3.5	24/06/2018	104	8.3	07/07/2018	102	0.2
29/04/2018	106	1.1	28-May-18	105	5.9	25/06/2018	106	11.2	19/07/2018	104	2.5
									22/07/2018	103	5.8
									07/07/2018	101	10.1
Dixon			April		May		Harvested Out				
05/04/2018	105	8.1	2-Mar-18	105	14.0						

Harvesting

Hydrex Peroxide

1000

05/04/2018	107	13.8	28-May-18	107	12.4	
14/04/2018	101	13.5				
18/04/2018	104	18.1				
18/04/2018	106	19.7				
28/04/2018	101	24.8				
Fortune						
14/04/2018	106	0.6	28-May-18	106	3.8	July
16/04/2018	106	0.3	28-May-18	104	3.3	08/07/2018 101 8.7
16/04/2018	105	0.5	28-May-18	105	4.4	08/07/2018 103 5.8
18/04/2018	102	0.6				21/07/2018 102 3.2
26/04/2018	106	1.2				08/07/2018 105 10.6
27/04/2018	104	1.5				20/07/2018 105 0.9
29/04/2018	101	2.1				08/07/2018 106 6.2
						20/07/2018 109 1.4
Millar						
01/04/2018	101	29.1	Harvested Out			
Mussel Rock						
02/04/2018	103	2.2	1-May-18	102	6.5	June
03/04/2018	105	1.8	12-May-18	101	10.7	09/06/2018 101 23.1
14/04/2018	101	6.9	15-May-18	111	9.4	10/06/2018 103 7.8
16/04/2018	104	2.5	15-May-18	109	9.6	11/06/2018 102 11.8
16/04/2018	106	2.1	25-May-18	101	17.1	24/06/2018 101 35.8
28/04/2018	101	8.7	29-May-18	110	8.4	
30/04/2018	107	3.7	29-May-18	105	7.0	
Plover						
01/04/2018	104	0.8	26-May-18	101	1.7	July
01/04/2018	108	1.0	27-May-18	104	3.7	05/07/2018 104 4.2
13/04/2018	101	0.6	29-May-18	101	3.5	17/07/2018 101 7.4
14/04/2018	104	1.6	29-May-18	108	9.1	05/07/2018 101 4.8
15/04/2018	105	0.9	29-May-18	105	4.7	05/07/2018 102 2.4
27/04/2018	108	3.0				20/07/2018 105 6.9
27/04/2018	109	1.7				18/07/2018 103 6.6
29/04/2018	101	1.5				
Rant						
02/04/2018	101	4.1	10-May-18	103	5.4	August
12/04/2018	110	4.8	10-May-18	105	5.0	some Harvesting
12/04/2018	109	3.5	14-May-18	101	9.1	17/07/2018 102 20.5
16/04/2018	101	5.9	24-May-18	104	6.6	05/07/2018 104 16.2
26/04/2018	102	7.5	24-May-18	106	9.3	16/07/2018 101 10.6
27/04/2018	104	6.3	28-May-18	101	15.1	05/07/2018 101 16.6
30/04/2018	101	8.1	30-May-18	101	9.4	17/07/2018 103 17.3
			30-May-18	108	13.9	05/07/2018 103 14.9
			30-May-18	107	6.1	
Ross Pass						
01/04/2018	105	16.8	1-May-18	104	31.1	Harvested Out
02/04/2018	104	20.2	1-May-18	105	32.7	
14/04/2018	101	34.4	10-May-18	105	34.7	

Peroxide was proposed for treatment in May, we have no indication that this took place, we can check on site during audits next week.

Peroxide was proposed for treatment in May, we have no indication that this took place, we can check on site during audits next week.

000992

Paylor, Adrienne

From: Paylor, Adrienne
Sent: September-11-18 12:37 PM
To: Webb, Allison
Subject: Re: Bioassay report for Bawden

No Zac got back to him and said we don't share raw lab results

Sent from my BlackBerry 10 smartphone on the Rogers network.

From: Webb, Allison
Sent: Tuesday, September 11, 2018 12:11 PM
To: Paylor, Adrienne
Subject: RE: Bioassay report for Bawden

Do we still need to follow up on this?

Allison Webb, Director / Directrice
Aquaculture Management / Gestion de l'aquaculture

Fisheries Management Branch / Direction de la gestion des pêches

Fisheries and Oceans Canada / Pêches et Océans Canada

200 - 401 Burrard St / Rue Burrard, Vancouver BC / C.B. V6C 3S4 Canada

604-666-7009

Allison.webb@dfo-mpo.gc.ca

From: Paylor, Adrienne
Sent: Wednesday, August 29, 2018 4:13 PM
To: Webb, Allison <Allison.Webb@dfo-mpo.gc.ca>
Subject: Fw: Bioassay report for Bawden

I'm inclined to share the results with Ahousat but not sure if [REDACTED] represents them or not? Should we discuss before we start sharing one off lab results based on individual requests?

Sent from my BlackBerry 10 smartphone on the Rogers network.

From: Waddington, Zac <Zac.Waddington@dfo-mpo.gc.ca>
Sent: Wednesday, August 29, 2018 3:24 PM
To: Paylor, Adrienne
Subject: FW: Bioassay report for Bawden

s.19(1)

I responded to an information request by a guy named [REDACTED] from an organization in the Tofino area called the Cedar Coast Field Station, which is located on Vargus Island just north of Tofino. We chatted on the phone yesterday, [REDACTED] and I spoke with him about the lice situation in Clayoquot, and what measures were being taken by us and Cermaq to ensure it did not happen again. He mentioned that they (and Ahousat) have been asking Cermaq to share their bioassay results with them, but thus far had not had any response from Cermaq. I did mention that we've done our own bioassay, and now today he's come back and asked to see any bioassay data available. I think that we could and should share our own bioassay (see attached), which is publicly funded through us anyway. Would you have issue with that? I did say that I cannot share industry data which has been shared with me in confidence.

Zac

From: Keith, Ian
Sent: June-04-18 1:50 PM
To: Waddington, Zac
Subject: FW: Bioassay report for Bawden

Hi Zac,

Here are the Bawden bioassay results, which appear similar to 2018 Rant, Saranac and Ross ie adult females more resistant than adult males and pre-adults. The re-fresh as Howie calls it, the genetic influence from wild fish lice, are seen in the adult males and the pre-adults, but the adult females are the old genetics.
(Normally post treatment of wild lice, we see adult males has more resistant. My working hypothesis is that there are inducible resistance mechanisms, for example, inducible enzymes.)

Ian

From: [REDACTED]
Sent: June-04-18 1:00 PM
To: Keith, Ian
Cc: [REDACTED]
Subject: Bioassay report for Bawden

Hi Ian

I have completed the report for the Bioassay done for Bawden sea lice.

We had lot of lice so I increased the replicates to 4 per male and female and managed to get 2 trays of pre-adult females. I did a Probit for the 2 replicates of pre-females just to get an idea of what their levels were.

Please feel free to contact me if you have any questions.

Cheers,

[REDACTED]

BC Centre for Aquatic Health Sciences
Street Address: 871A Island Hwy, Campbell River, BC
Mailing Address: PO Box 25070 Tyee, Campbell River, BC, Canada V9W 0B7
ph: 250 286-6102 f: 250 286-6103
email: [REDACTED]
web: www.caahs-bc.ca

Waddington, Zac

From: Paylor, Adrienne
Sent: September-19-18 2:47 PM
To: McCorquodale, Brenda; Waddington, Zac
Cc: Patirana, Anoma
Subject: RE: Sea Lice Graphs ready for your review

- Yes I think we should prepare a management response. We are also getting media inquiries about this today. Zac do you have some bullets from when you briefed Allison? We are making them treat the smolts before restocking etc.

From: McCorquodale, Brenda
Sent: September-19-18 2:37 PM
To: Paylor, Adrienne
Cc: Patirana, Anoma
Subject: RE: Sea Lice Graphs ready for your review

So what is our management response?

What is our explanation of how we have responded to a threshold which is being far exceeded, during the outmigration window? Do we prepare a management response?

[REDACTED] If it were individual farms it would probably look much more localized and scary than the average numbers.

Brenda

Brenda McCorquodale

Regional Manager, Aquaculture Resource Management
Fisheries and Oceans Canada
Gestionnaire régionale des ressources, Direction des pêches
Pêches et Océans Canada

1965 Island Diesel Way | Nanaimo, BC | Nanaimo, CB | V9S 5W8
Email | Courriel: Brenda.McCorquodale@dfo-mpo.gc.ca
Telephone | Téléphone: 250-902-8865

From: Paylor, Adrienne
Sent: Tuesday, September 18, 2018 4:28 PM
To: Waddington, Zac; Taekema, Bernie John
Cc: McCorquodale, Brenda; Patirana, Anoma
Subject: FW: Sea Lice Graphs ready for your review

We should share these graphs with the IPM group for our call next week.
Adrienne

From: Waddington, Zac
Sent: September-18-18 3:38 PM
To: Sandberg, Krista
Subject: RE: Sea Lice Graphs ready for your review

s.21(1)(a)

s.21(1)(b)

Approved! Though it is shockingly ugly in 2.3....

Zac

From: Sandberg, Krista
Sent: September-18-18 3:04 PM
To: Waddington, Zac
Subject: Sea Lice Graphs ready for your review

Hi Zac,

Another one for you – the zone level sea lice exceedance bar graph is ready for your approval – up to July. Clayoquot is quite shocking...

\\Dcbcvanna01b\VAN_RHQ_4\Aqua\1. PUBLIC REPORTING\9. Sea Lice\2. Exceedance Graphs - Quarterly\SL Zone Level Graph for WEB.xls

Krista Sandberg

Aquaculture Data Coordinator | Coordonnateur de données sur l'aquaculture
Aquaculture Management Division | Gestion de l'aquaculture
Fisheries and Oceans Canada | Pêches et Océans Canada

krista.sandberg@dfo-mpo.gc.ca

Office | Bureau 250-286-5835

Cellular | Cellulaire [REDACTED]



Government
of Canada

Gouvernement
du Canada

Canada

s.16(2)(c)

Waddington, Zac

From: Waddington, Zac
Sent: September-19-18 3:13 PM
To: Rainer, Michelle; Paylor, Adrienne
Subject: RE: media query, re Cermaq and sea lice

My understanding of the culling of Fortune Channel was that it was multifactorial, but not strictly due to lice. In fact they had just conducted a SLICE treatment prior to the culling, with good effect. Due to numerous past environmental challenges (low DOs, harmful algal blooms, water sedimentation), [REDACTED]

[REDACTED] That's the extent of my understanding at least.

Hopefully Cermaq will be willing/able to provide more detail.

Zac

From: Rainer, Michelle
Sent: September-19-18 2:41 PM
To: Waddington, Zac; Paylor, Adrienne
Subject: FW: media query, re Cermaq and sea lice

More info

From: [REDACTED]
Sent: September-19-18 2:17 PM
To: Rainer, Michelle
Subject: RE: media query, re Cermaq and sea lice

Thanks.

No release as far as I know.

I learned about it here:

<https://hashilthsa.com/news/2018-09-17/high-sea-lice-counts-leads-cermaq-close-farm-site-clayoquot-sound>

I spoke to Cermaq briefly today and was told two letters had been sent out on the issue. I requested them but have not yet received them.

From: Rainer, Michelle [mailto:Michelle.Rainer@dfo-mpo.gc.ca]
Sent: Wednesday, September 19, 2018 2:15 PM
To: [REDACTED]
Subject: RE: media query, re Cermaq and sea lice

s.19(1)

s.20(1)(b)

s.21(1)(b)

Hi [REDACTED]

I will look into it for you. Was there some sort of release about this?

Thanks,
Michelle

From: [REDACTED]
Sent: September-19-18 1:49 PM

To: RHQ - Media.PAC

Subject: media query, re Cermaq and sea lice

Good day.

My name is [REDACTED] reporter with the Globe and Mail.

I'm working on a story about Cermaq closing one of its sites, apparently in relation to sea lice concerns. (I haven't yet talked directly to the company but I have put in a request.)

I'm hoping to speak to someone at DFO about this development and about sea lice concerns in general.

My deadline to speak to someone is 4 pm Pacific time tomorrow – Thursday September 20.

I can be reached via email or at [REDACTED]

Thank you,

[REDACTED]



[REDACTED]

s.19(1)

Jones, Simon

From: Rainer, Michelle
Sent: Wednesday, September 19, 2018 3:36 PM
To: Jones, Simon
Subject: ML_AQUA_SeaLiceClayoquot.doc
Attachments: ML_AQUA_SeaLiceClayoquot.doc

Categories: Yellow Category

Page 1000
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page 783

Patirana, Anoma

From: Patirana, Anoma
Sent: September-19-18 4:30 PM
To: Paylor, Adrienne; McCorquodale, Brenda
Subject: Re: FYI media call on sea lice today

I think you mentioned briefly before but thank you for the update!

Sent from my Bell Samsung device over Canada's largest network.

----- Original message -----

From: "Paylor, Adrienne" <Adrienne.Paylor@dfo-mpo.gc.ca>
Date: 2018-09-19 4:17 PM (GMT-08:00)
To: "McCorquodale, Brenda" <Brenda.McCorquodale@dfo-mpo.gc.ca>, "Patirana, Anoma" <Anoma.Patirana@dfo-mpo.gc.ca>
Subject: FYI media call on sea lice today

Just for your awareness we got a call from media today regarding sea lice in the Clayquot area. CRMAQ had to cull a farm this summer (high lice was just one of many reasons why) so this may come up in conversations and I'm not sure if I fully debriefed about this on management calls? Anyway some details below and I'll let you know where it goes tomorrow:

From: Paylor, Adrienne
Sent: September-19-18 4:00 PM
To: Webb, Allison
Subject: No notes from the ROCS call :)

Took the ROCS call and nothing significant to report.

On an internal program note we did get a media inquiry today regarding the Cull at Fortune Channel (in Aug) which they heard was done due to high sea lice numbers. This is a CRMAQ farm in Clayquot Sound so could spark the SLICE resistance and over exceedance issue from this spring. We have responded that the cull was not ordered by DFO nor was it done as a condition of our licence. We will see if that satisfies the inquiry. For your own information we did look into the cull and found it was for multifactorial conditions, not strictly due to lice. In fact they had just conducted a SLICE treatment prior to the culling, with good effect.

Media has been redirected to Cermaq for more details.

s.20(1)(b)

s.21(1)(b)

Rainer, Michelle

From: Waddington, Zac
Sent: September-19-18 4:45 PM
To: Rainer, Michelle; Paylor, Adrienne
Cc: McCorquodale, Brenda; Patirana, Anoma; Webb, Allison
Subject: RE: ML_AQUA_SeaLiceClayoquot.doc

Those media lines are still correct. Unfortunately there is no update [REDACTED]

[REDACTED] You may be able to ask Claire Doucette for an update, but I haven't heard anything from them for some time.

The only thing to add is that Cermaq has begun to restock some of their sites which were harvested out in the spring. They are restocking those farms which have fallowed longest, first. And all current transfers of fish into Clayoquot have been treated in the hatchery with a drug called Imvixa which prevents lice colonization for 6-9 months, in the same manner (using the same drug) as flea treatments for cats and dogs. Cermaq has a mechanical lice removal tool (hydrolicer) in development in Norway with an expected arrival for February-March of 2019. The coverage provided by the Imvixa will ensure that lice levels are negligible entering the outmigration of 2019, and then the hydrolicer will be available for use as needed to ensure lice levels are managed without necessitating SLICE during the outmigration. In discussions with Cermaq, this plan was deemed appropriate mitigation, and as a result restocking of those sites was allowed.

Please let me know if you need further details. Feel free to repackage any of the above into media lines as you see fit.

Zac

From: Rainer, Michelle
Sent: September-19-18 3:27 PM
To: Paylor, Adrienne; Waddington, Zac
Subject: ML_AQUA_SeaLiceClayoquot.doc

Hi Adrienne,

As agreed, I'll refer her to Cermaq, send her the sea lice infographic and ask her to submit any follow-up questions in writing. These are the media lines from earlier this year; can you please update on the actions referenced?

Thanks,
Michelle

s.21(1)(a)

s.21(1)(b)

Waddington, Zac

From: Jones, Simon
Sent: September-20-18 2:58 PM
To: Waddington, Zac
Subject: FW: media query, re Cermaq and sea lice

See link below ...

From: Rainer, Michelle
Sent: September-19-18 3:21 PM
To: Jones, Simon
Subject: FW: media query, re Cermaq and sea lice

From: [REDACTED]
Sent: September-19-18 2:17 PM
To: Rainer, Michelle
Subject: RE: media query, re Cermaq and sea lice

Thanks.

No release as far as I know.

I learned about it here:

<https://hashilthsa.com/news/2018-09-17/high-sea-lice-counts-leads-cermaq-close-farm-site-clayoquot-sound>

I spoke to Cermaq briefly today and was told two letters had been sent out on the issue. I requested them but have not yet received them.

From: Rainer, Michelle [<mailto:Michelle.Rainer@dfo-mpo.gc.ca>]
Sent: Wednesday, September 19, 2018 2:15 PM
To: [REDACTED]
Subject: RE: media query, re Cermaq and sea lice

Hi [REDACTED]

I will look into it for you. Was there some sort of release about this?

Thanks,
Michelle

From: [REDACTED]
Sent: September-19-18 1:49 PM
To: RHQ - Media.PAC
Subject: media query, re Cermaq and sea lice

s.19(1)

Good day.

My name is [REDACTED] reporter with the Globe and Mail.

I'm working on a story about Cermaq closing one of its sites, apparently in relation to sea lice concerns. (I haven't yet talked directly to the company but I have put in a request.)

I'm hoping to speak to someone at DFO about this development and about sea lice concerns in general.

My deadline to speak to someone is 4 pm Pacific time tomorrow – Thursday September 20.

I can be reached via email or at [REDACTED]

Thank you,

- [REDACTED]



s.19(1)

Paylor, Adrienne

From: Paylor, Adrienne
Sent: September-20-18 3:10 PM
To: Doucette, Claire
Cc: Webb, Allison; Waddington, Zac
Subject: FW: media query, re Cermaq and sea lice

Hi Claire,

Just as a heads up we have had follow up inquiries from the media regarding enforcement actions in Clayoquot Sound. Globeandmail has asked :

- Given the level of sea lice infestations in Clayoquot Sound this year, is DFO doing any additional monitoring or enforcement in the area?

I would like to touch base next week to prepare a formal response on how the department plans to proceed so hopefully we speak to the enforcement question. If I remember correctly this was an issue of resources and priorities more than case file issues? We will need to discuss with Allison as well in order to finalize our program response.

Thx Adrienne

From: Waddington, Zac
Sent: September-20-18 1:47 PM
To: Rainer, Michelle; Jones, Simon; Paylor, Adrienne
Subject: RE: media query, re Cermaq and sea lice

We are not doing any additional monitoring. We did discuss this possibility; however we are very confident in the monitoring taking place by various eNGO's in the area (one of whom I've spoken with), and third party environmental consultants hired by Cermaq. Unfortunately, we know from past experiences where lice levels have been unmanaged that it does correlate to higher lice levels on out migrating smolts. It was decided that our additional monitoring would not contribute significantly to the understanding of the lice situation in Clayoquot.

That said, we did conduct an independent bioassay (test of SLICE resistance in the lice) using lice from a farm affected with SLICE resistance and significant lice burden. That bioassay confirmed resistance, and the lice from that test were sent to a researcher to help support some genetics work that is being done to better understand the genetic basis for resistance.

Hope that helps,

Zac

From: Rainer, Michelle
Sent: September-20-18 1:25 PM
To: Jones, Simon; Waddington, Zac; Paylor, Adrienne
Subject: FW: media query, re Cermaq and sea lice
Importance: High

Hi there,

Looks like she has all the info she needs from Cermaq about reasons for the closure. Can any of you provide a response to her questions about monitoring in the area? Her deadline is this afternoon so hoping for a quick turnaround 😊.

Thanks,
Michelle

From: [REDACTED]
Sent: September-20-18 11:21 AM
To: Rainer, Michelle
Subject: RE: media query, re Cermaq and sea lice

Hi Michelle, thanks for your email.
I did speak to Cermaq this morning.
The infographic is informative.

A follow-up question:

- Given the level of sea lice infestations in Clayoquot Sound this year, is DFO doing any additional monitoring or enforcement in the area?

From: Rainer, Michelle [mailto:Michelle.Rainer@dfo-mpo.gc.ca]
Sent: Wednesday, September 19, 2018 3:49 PM
To: [REDACTED]
Subject: RE: media query, re Cermaq and sea lice

Hi [REDACTED]

I have confirmed that Cermaq's decision isn't as a result of any directive from DFO so the company is the best source of info for the reasoning behind the closure. If you have any questions for us after speaking to them, can you please submit them in writing?

I've attached an infographic we've recently made that explains L. salmonis (the salmon louse) monitoring and regulations. I hope you find this useful as background. It's new and you're the first person outside of DFO who will have seen it, so I would welcome your feedback if there's anything you find confusing!

Regards,
Michelle Rainer
Communications Advisor | Conseillère en communications
Fisheries and Oceans Canada | Pêches et Océans Canada
200 - 401 Burrard Street, Vancouver, B.C. V6C 3S4 | 200 - 401 rue Burrard, Vancouver, C.-B. V6C 3S4
Telephone | Téléphone 604-775-5065

From: [REDACTED]
Sent: September-19-18 2:17 PM
To: Rainer, Michelle
Subject: RE: media query, re Cermaq and sea lice

Thanks.
No release as far as I know.
I learned about it here:
<https://hashilthsa.com/news/2018-09-17/high-sea-lice-counts-leads-cermaq-close-farm-site-clayoquot-sound>
I spoke to Cermaq briefly today and was told two letters had been sent out on the issue. I requested them but have not yet received them.

s.19(1)

From: Rainer, Michelle [mailto:Michelle.Rainer@dfo-mpo.gc.ca]

Sent: Wednesday, September 19, 2018 2:15 PM

To: [REDACTED]

Subject: RE: media query, re Cermaq and sea lice

Hi [REDACTED]

I will look into it for you. Was there some sort of release about this?

Thanks,

Michelle

From: [REDACTED]

Sent: September-19-18 1:49 PM

To: RHQ - Media.PAC

Subject: media query, re Cermaq and sea lice

Good day.

My name is [REDACTED] reporter with the Globe and Mail.

I'm working on a story about Cermaq closing one of its sites, apparently in relation to sea lice concerns. (I haven't yet talked directly to the company but I have put in a request.)

I'm hoping to speak to someone at DFO about this development and about sea lice concerns in general.

My deadline to speak to someone is 4 pm Pacific time tomorrow – Thursday September 20.

I can be reached via email or at [REDACTED]

Thank you,

- [REDACTED]



Waddington, Zac

From: Waddington, Zac
Sent: September-20-18 3:13 PM
To: Paylor, Adrienne
Subject: RE: ML_AQUA_SeaLiceClayoquot.doc

I've added my comments in red. See what you think,

Very good questions Brenda and I think we should discuss at the upcoming managers meeting if we get a chance. Traditionally all fish health and parasite treatment and husbandry advisements come for our lead veterinarian who is trained & licenced to practice medicine and qualified to provide direction to other certified industry veterinarians. To my understanding this situation in Clayoquot is unprecedented in that we have never used the transfer licence to require a hatchery treatment or have we required the use of this drug. Theoretically the Imvixa treatment should prevent lice colonization up to the beginning of the outmigration window, but this will be our first field trial of it in BC. Cermaq is developing a mechanical removal technology (the hydrolicer) which is slated to arrive in BC in February-March 2019, this should allow lice treatment following the period of Imvixa efficacy, without reliance on SLICE. Allison was briefed by Zac during the deliberations and consultations with industry pertaining to the restocking of these Cermaq sites.

[REDACTED]

From: Paylor, Adrienne
Sent: September-20-18 2:52 PM
To: Waddington, Zac
Subject: RE: ML_AQUA_SeaLiceClayoquot.doc

s.21(1)(a)
s.21(1)(b)

Please review and correct for me ☺ thx

Very good questions Brenda and I think we should discuss at the upcoming managers meeting if we get a chance. Traditionally all fish health and parasite treatment and husbandry advisements come for our lead veterinarian who is trained & licenced to practice medicine and qualified to provide direction other certified industry veterinarians. To my understanding this situation in Clayoquot is unprecedented in that we have never used the transfer licence to require a hatchery treatment or have we required the use of this drug. Theoretically the Imvixa treatment should get through the outmigration window but this will be our first field trial of it in BC.

[REDACTED]

From: McCorquodale, Brenda
Sent: September-20-18 11:21 AM
To: Paylor, Adrienne
Cc: Patirana, Anoma; Webb, Allison
Subject: RE: ML_AQUA_SeaLiceClayoquot.doc

Just some general thoughts and questions – it may just be that I haven't been engaged in this because it's not my area, but I'm still interested. ☺

If they have already started treating and stocking, and the life of the drug is 6 – 9 mo, what is the confidence that the fish will still be lice-resistant during the outmigration period?

I am curious - Did we consider the management options available to us before approving restocking? Do we have a process for reviewing/approving management response approaches like this – does the Manager, the Director, or Andy review and approve - or is this just a decision we let the vets make?

Brenda

Brenda McCorquodale

Regional Manager, Aquaculture Resource Management
Fisheries and Oceans Canada
Gestionnaire régionale des ressources, Direction des pêches
Pêches et Océans Canada

1965 Island Diesel Way | Nanaimo, BC | Nanaimo, CB | V9S 5W8
Email | Courriel: Brenda.McCorquodale@dfo-mpo.gc.ca
Telephone | Téléphone: 250-902-8865

From: Waddington, Zac
Sent: Wednesday, September 19, 2018 4:45 PM
To: Rainer, Michelle; Paylor, Adrienne
Cc: McCorquodale, Brenda; Patirana, Anoma; Webb, Allison
Subject: RE: ML_AQUA_SeaLiceClayoquot.doc

Those media lines are still correct. Unfortunately there is no update [REDACTED]

[REDACTED] You may be able to ask Claire Doucette for an update, but I haven't heard anything from them for some time.

The only thing to add is that Cermaq has begun to restock some of their sites which were harvested out in the spring. They are restocking those farms which have fallowed longest, first. And all current transfers of fish into Clayoquot have been treated in the hatchery with a drug called Imvixa which prevents lice colonization for 6-9 months, in the same manner (using the same drug) as flea treatments for cats and dogs. Cermaq has a mechanical lice removal tool (hydrolicer) in development in Norway with an expected arrival for February-March of 2019. The coverage provided by the Imvixa will ensure that lice levels are negligible entering the outmigration of 2019, and then the hydrolicer will be available for use as needed to ensure lice levels are managed without necessitating SLICE during the outmigration. In discussions with Cermaq, this plan was deemed appropriate mitigation, and as a result restocking of those sites was allowed.

Please let me know if you need further details. Feel free to repackage any of the above into media lines as you see fit.

Zac

From: Rainer, Michelle
Sent: September-19-18 3:27 PM
To: Paylor, Adrienne; Waddington, Zac
Subject: ML_AQUA_SeaLiceClayoquot.doc

Hi Adrienne,

As agreed, I'll refer her to Cermaq, send her the sea lice infographic and ask her to submit any follow-up questions in writing. These are the media lines from earlier this year; can you please update on the actions referenced?

Thanks,

s.21(1)(a)

s.21(1)(b)

Michelle

No information has been removed or severed from this page

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page 783

Paylor, Adrienne

From: Paylor, Adrienne
Sent: September-20-18 3:51 PM
To: Rainer, Michelle
Subject: RE: media query, re Cermaq and sea lice

DFO had enough confidence the smolt collection monitoring that was already being conducted by third party groups (NGO's and environmental consultants) that a decision was made to complement this monitoring by collecting sea lice samples to provide additional information on the level of resistance and genetic coding.

From: Rainer, Michelle
Sent: September-20-18 3:36 PM
To: Paylor, Adrienne
Subject: FW: media query, re Cermaq and sea lice

Adrienne, is this OK with you? (I'll clean it up, of course!)

From: Waddington, Zac
Sent: September-20-18 3:26 PM
To: Rainer, Michelle
Subject: RE: media query, re Cermaq and sea lice

See my edits below in red:

- DFO is very confident in the monitoring being done in the Clayoquot area by environmental non-government groups including Cedar Coast Field Station and third party environmental consultants hired by Cermaq. Arrangements have been made for these groups to share their data with DFO [unfortunately we have not made arrangements to have this data shared with us]. For this reason, the Department determined that additional monitoring by the Department would not contribute significantly to the understanding of the sea lice situation in Clayoquot. Instead resources were allocated to performing an independent bioassay (which quantifies and confirms resistance) and supporting ongoing research being conducted to determine the genetic basis for resistance. ~~resources would be better directed at other activities and would not contribute to a better understanding of the sea lice situation in Clayoquot.~~
- In BC, salmon farming companies use an in-feed therapeutant called SLICE to reduce lice abundance. During most years, more than 90% of sites are below the regulatory thresholds for sea lice during the wild salmon outmigration period (from March 1 to June 30 of each year).
- DFO is keeping a close eye on the issue of SLICE resistance.
- DFO collected sea lice from Cermaq Canada's Bawden site in the Clayoquot area and sent them to the BC Centre for Aquatic Health Sciences for analysis, which confirmed SLICE resistance. Those lice were later sent to Mark Fast, a researcher out of Atlantic Veterinary College who is undertaking work to better understand the genetic basis for SLICE resistance. SLICE resistance is an emerging issue in BC. In recent years, failures of treatment have also been documented at Klemtu in 2015 and Esperanza Inlet in 2017.
- Research is under way, by DFO, industry, and academia, to find alternative methods to manage sea lice, and to better predict and track SLICE resistance. For instance, DFO is currently studying, or supporting research on, the use of Pacific perch as "cleaner fish" that eat sea lice off farmed fish and warm water baths to kill sea lice. More information on these projects can be found at www.dfo-mpo.gc.ca/aquaculture/sci-res/rd-eng.htm.

- DFO is also supporting the licensing and approval process for alternative sea lice treatments, which are a necessary part of an integrated pest management approach.

From: Rainer, Michelle
Sent: September-20-18 2:52 PM
To: Waddington, Zac; Jones, Simon; Paylor, Adrienne
Subject: RE: media query, re Cermaq and sea lice

Thanks, Zac. I have some lines already approved (by you, I think) on the SLICE bioassay. At least I think this is the same thing.

For response, how about:

- DFO is very confident in the monitoring being done in the Clayoquot area by environmental non-government groups including, ?? ?? [which groups??] and third party environmental consultants hired by Cermaq. Arrangements have been made for these groups to share their data with DFO [can we say that?]. For this reason, the Department determined that resources would be better directed at other activities and would not contribute to a better understanding of the sea lice situation in Clayoquot.
- In BC, salmon farming companies use an in-feed therapeutant called SLICE to reduce lice abundance. During most years, more than 90% of sites are below the regulatory thresholds for sea lice during the wild salmon outmigration period (from March 1 to June 30 of each year).
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From: Waddington, Zac
Sent: September-20-18 1:47 PM
To: Rainer, Michelle; Jones, Simon; Paylor, Adrienne
Subject: RE: media query, re Cermaq and sea lice

We are not doing any additional monitoring. We did discuss this possibility; however we are very confident in the monitoring taking place by various eNGO's in the area (one of whom I've spoken with), and third party environmental consultants hired by Cermaq. Unfortunately, we know from past experiences where lice levels have been unmanaged that it does correlate to higher lice levels on out migrating smolts. It was decided that our additional monitoring would not contribute significantly to the understanding of the lice situation in Clayoquot.

That said, we did conduct an independent bioassay (test of SLICE resistance in the lice) using lice from a farm affected with SLICE resistance and significant lice burden. That bioassay confirmed resistance, and the lice from that test were sent to a researcher to help support some genetics work that is being done to better understand the genetic basis for resistance.

Hope that helps,

Zac

From: Rainer, Michelle
Sent: September-20-18 1:25 PM
To: Jones, Simon; Waddington, Zac; Paylor, Adrienne
Subject: FW: media query, re Cermaq and sea lice
Importance: High

Hi there,
Looks like she has all the info she needs from Cermaq about reasons for the closure. Can any of you provide a response to her questions about monitoring in the area? Her deadline is this afternoon so hoping for a quick turnaround 😊.
Thanks,
Michelle

From: [REDACTED]
Sent: September-20-18 11:21 AM
To: Rainer, Michelle
Subject: RE: media query, re Cermaq and sea lice

Hi Michelle, thanks for your email.
I did speak to Cermaq this morning.
The infographic is informative.

A follow-up question:

- Given the level of sea lice infestations in Clayoquot Sound this year, is DFO doing any additional monitoring or enforcement in the area?

From: Rainer, Michelle [mailto:Michelle.Rainer@dfo-mpo.gc.ca]
Sent: Wednesday, September 19, 2018 3:49 PM
To: [REDACTED]
Subject: RE: media query, re Cermaq and sea lice

Hi [REDACTED]

I have confirmed that Cermaq's decision isn't as a result of any directive from DFO so the company is the best source of info for the reasoning behind the closure. If you have any questions for us after speaking to them, can you please submit them in writing?

I've attached an infographic we've recently made that explains *L. salmonis* (the salmon louse) monitoring and regulations. I hope you find this useful as background. It's new and you're the first person outside of DFO who will have seen it, so I would welcome your feedback if there's anything you find confusing!

Regards,
Michelle Rainer
Communications Advisor | Conseillère en communications

s.19(1)

From: [REDACTED]
Sent: September-19-18 2:17 PM
To: Rainer, Michelle
Subject: RE: media query, re Cermaq and sea lice

Thanks.
No release as far as I know.
I learned about it here:
<https://hashilthsa.com/news/2018-09-17/high-sea-lice-counts-leads-cermaq-close-farm-site-clayoquot-sound>
I spoke to Cermaq briefly today and was told two letters had been sent out on the issue. I requested them but have not yet received them.

From: Rainer, Michelle [<mailto:Michelle.Rainer@dfo-mpo.gc.ca>]
Sent: Wednesday, September 19, 2018 2:15 PM
To: [REDACTED]
Subject: RE: media query, re Cermaq and sea lice

Hi [REDACTED]
I will look into it for you. Was there some sort of release about this?
Thanks,
Michelle

From: [REDACTED]
Sent: September-19-18 1:49 PM
To: RHQ - Media.PAC
Subject: media query, re Cermaq and sea lice

Good day.
My name is [REDACTED] reporter with the Globe and Mail.
I'm working on a story about Cermaq closing one of its sites, apparently in relation to sea lice concerns. (I haven't yet talked directly to the company but I have put in a request.)
I'm hoping to speak to someone at DFO about this development and about sea lice concerns in general.
My deadline to speak to someone is 4 pm Pacific time tomorrow – Thursday September 20.
I can be reached via email or at [REDACTED]
Thank you,

- [REDACTED]
s.19(1)



Bate, Dan

From: Rainer, Michelle
Sent: September-20-18 4:16 PM
To: Bate, Dan
Subject: FW: media query, re Cermaq and sea lice

Hi Dan,

[REDACTED] This is what's with Andy for approval; I'll watch my BB and let you know when he approves.

Thanks,
Michelle

From: Rainer, Michelle
Sent: September-20-18 3:57 PM
To: Thomson, Andrew
Subject: FW: media query, re Cermaq and sea lice

Hi Andy, for your approval

From: Rainer, Michelle
Sent: September-20-18 3:52 PM
To: Paylor, Adrienne
Subject: FW: media query, re Cermaq and sea lice

Issue: [REDACTED] Globe and Mail ([REDACTED]). She is working on a story about Cermaq closing one of its sites, apparently in relation to sea lice concerns.

She has already spoken to Cermaq and has a follow-up question for DFO:

Given the level of sea lice infestations in Clayoquot Sound this year, is DFO doing any additional monitoring or enforcement in the area?

Deadline: Thursday, September 20 at 5 p.m.
Approved by: Zac Waddington, Adrienne Paylor
Media lines:

- Fisheries and Oceans Canada (DFO) is confident in the smolt collection monitoring already being conducted by third party groups (environmental non-government groups and consultants). DFO has complemented this work by collecting sea lice samples that will provide additional information on the level of SLICE resistance and genetic coding.
- Instead, DFO resources were allocated to performing an independent bioassay and supporting ongoing research to determine the genetic basis for SLICE resistance. SLICE is an in-feed therapeutant that BC salmon farming companies use to reduce lice abundance.
- DFO is keeping a close eye on the issue of SLICE resistance. The Department collected sea lice from Cermaq Canada's Bawden site in the Clayoquot area and sent them to the BC Centre for Aquatic Health Sciences for analysis, which confirmed SLICE resistance. Those lice were later sent to Mark Fast, a researcher out of Atlantic Veterinary College who is undertaking work to better understand the genetic basis for SLICE resistance.

s.19(1)

- During most years, more than 90% of sites in BC are below the regulatory thresholds for sea lice during the wild salmon outmigration period (from March 1 to June 30 of each year). However, there were documented failures of SLICE treatment at Klemtu in 2015 and Esperanza Inlet in 2017 and now Clayoquot Sound in 2018.
- Research is under way, by DFO, industry, and academia, to find alternative methods to manage sea lice, and to better predict and track SLICE resistance. For instance, DFO is currently studying, or supporting research on, the use of Pacific perch as “cleaner fish” that eat sea lice off farmed fish and warm water baths to kill sea lice. More information on these projects can be found at www.dfo-mpo.gc.ca/aquaculture/sci-res/rd-eng.htm.
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Sent: September-20-18 1:47 PM
To: Rainer, Michelle; Jones, Simon; Paylor, Adrienne
Subject: RE: media query, re Cermaq and sea lice

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That said, we did conduct an independent bioassay (test of SLICE resistance in the lice) using lice from a farm affected with SLICE resistance and significant lice burden. That bioassay confirmed resistance, and the lice from that test were sent to a researcher to help support some genetics work that is being done to better understand the genetic basis for resistance.

Hope that helps,

Zac

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Sent: September-20-18 1:25 PM
To: Jones, Simon; Waddington, Zac; Paylor, Adrienne
Subject: FW: media query, re Cermaq and sea lice
Importance: High

Hi there,

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Thanks,
Michelle

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Sent: September-20-18 11:21 AM
To: Rainer, Michelle
Subject: RE: media query, re Cermaq and sea lice

s.19(1)

Hi Michelle, thanks for your email.

I did speak to Cermaq this morning.
The infographic is informative.

A follow-up question:

- Given the level of sea lice infestations in Clayoquot Sound this year, is DFO doing any additional monitoring or enforcement in the area?

From: Rainer, Michelle [mailto:Michelle.Rainer@dfo-mpo.gc.ca]

Sent: Wednesday, September 19, 2018 3:49 PM

To: [REDACTED]

Subject: RE: media query, re Cermaq and sea lice

Hi [REDACTED]

I have confirmed that Cermaq's decision isn't as a result of any directive from DFO so the company is the best source of info for the reasoning behind the closure. If you have any questions for us after speaking to them, can you please submit them in writing?

I've attached an infographic we've recently made that explains *L. salmonis* (the salmon louse) monitoring and regulations. I hope you find this useful as background. It's new and you're the first person outside of DFO who will have seen it, so I would welcome your feedback if there's anything you find confusing!

Regards,

Michelle Rainer

Communications Advisor | Conseillère en communications

Fisheries and Oceans Canada | Pêches et Océans Canada

200 - 401 Burrard Street, Vancouver, B.C. V6C 3S4 | 200 - 401 rue Burrard, Vancouver, C.-B. V6C 3S4

Telephone | Téléphone 604-775-5065

From: [REDACTED]

Sent: September-19-18 2:17 PM

To: Rainer, Michelle

Subject: RE: media query, re Cermaq and sea lice

Thanks.

No release as far as I know.

I learned about it here:

<https://hashilthsa.com/news/2018-09-17/high-sea-lice-counts-leads-cermaq-close-farm-site-clayoquot-sound>

I spoke to Cermaq briefly today and was told two letters had been sent out on the issue. I requested them but have not yet received them.

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Sent: Wednesday, September 19, 2018 2:15 PM

To: [REDACTED]

Subject: RE: media query, re Cermaq and sea lice

s.19(1)

Hi [REDACTED]

I will look into it for you. Was there some sort of release about this?

Thanks,

Michelle

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Sent: September-19-18 1:49 PM
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Good day.

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I'm hoping to speak to someone at DFO about this development and about sea lice concerns in general.

My deadline to speak to someone is 4 pm Pacific time tomorrow – Thursday September 20.

I can be reached via email or at [REDACTED]

Thank you,

[REDACTED]



[REDACTED]

s.19(1)

Bate, Dan

From: Bate, Dan
Sent: September-20-18 7:33 PM
To: Rainer, Michelle
Subject: Re: media query, re Cermaq and sea lice

Great thanks Michelle. Will pass it to RDG/Bonnie (she's acting tomorrow).

Dan

Get [Outlook for iOS](#)

On Thu, Sep 20, 2018 at 7:23 PM -0700, "Rainer, Michelle" <Michelle.Rainer@dfo-mpo.gc.ca> wrote:

Hi, Andy approved so ready for RDG and FYI. No rush as [REDACTED] can wait until tomorrow

Sent from my BlackBerry 10 smartphone on the Rogers network.

From: Thomson, Andrew <Andrew.Thomson@dfo-mpo.gc.ca>
Sent: Thursday, September 20, 2018 4:24 PM
To: Rainer, Michelle
Subject: RE: media query, re Cermaq and sea lice

approved

Andrew J L Thomson
Regional Director | Directeur Régionale
Fisheries Management Branch | Direction de la gestion des pêches

s.19(1)

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Hi Andy, for your approval

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To: Paylor, Adrienne
Subject: FW: media query, re Cermaq and sea lice

Issue: [REDACTED] Globe and Mail [REDACTED] She is working on a story about Cermaq closing one of its sites, apparently in relation to sea lice concerns.

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Deadline: Thursday, September 20 at 5 p.m.

Approved by: Zac Waddington, Adrienne Paylor

Media lines:

- Fisheries and Oceans Canada (DFO) was confident in the smolt collection monitoring that was already being conducted by third party groups (environmental non-government groups and consultants). For this reason, DFO decided to complement this monitoring by collecting sea lice samples to provide additional information on the level of SLICE resistance and genetic coding.
- Instead, DFO resources were allocated to performing an independent bioassay and supporting ongoing research to determine the genetic basis for SLICE resistance. SLICE is an in-feed therapeutant that BC salmon farming companies use to reduce lice abundance.
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Sent: September-20-18 1:47 PM

To: Rainer, Michelle; Jones, Simon; Paylor, Adrienne

Subject: RE: media query, re Cermaq and sea lice

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Importance: High

Hi there,
Looks like she has all the info she needs from Cermaq about reasons for the closure. Can any of you provide a response to her questions about monitoring in the area? Her deadline is this afternoon so hoping for a quick turnaround 😊.
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I did speak to Cermaq this morning.
The infographic is informative.

A follow-up question:

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Communications Advisor | Conseillère en communications
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200 - 401 Burrard Street, Vancouver, B.C. V6C 3S4 | 200 - 401 rue Burrard, Vancouver, C.-B. V6C 3S4
Telephone | Téléphone [604-775-5065](tel:604-775-5065)

s.19(1)

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My name is [REDACTED] with the Globe and Mail.

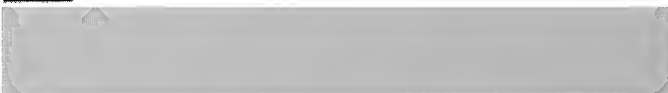
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s.19(1)

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Hi [REDACTED]

I have confirmed that Cermaq's decision isn't as a result of any directive from DFO so the company is the best source of info for the reasoning behind the closure. If you have any questions for us after speaking to them, can you please submit them in writing?

I've attached an infographic we've recently made that explains *L. salmonis* (the salmon louse) monitoring and regulations. I hope you find this useful as background. It's new and you're the first person outside of DFO who will have seen it, so I would welcome your feedback if there's anything you find confusing!

Regards,
Michelle Rainer
Communications Advisor | Conseillère en communications
Fisheries and Oceans Canada | Pêches et Océans Canada
200 - 401 Burrard Street, Vancouver, B.C. V6C 3S4 | 200 - 401 rue Burrard, Vancouver, C.-B. V6C 3S4
Telephone | Téléphone 604-775-5065

From: [REDACTED]
Sent: September-19-18 2:17 PM
To: Rainer, Michelle
Subject: RE: media query, re Cermaq and sea lice

Thanks.
No release as far as I know.
I learned about it here:
<https://hashilthsa.com/news/2018-09-17/high-sea-lice-counts-leads-cermaq-close-farm-site-clayoquot-sound>
I spoke to Cermaq briefly today and was told two letters had been sent out on the issue. I requested them but have not yet received them.

From: Rainer, Michelle [mailto:Michelle.Rainer@dfo-mpo.gc.ca]

Sent: Wednesday, September 19, 2018 2:15 PM

To: [REDACTED]

Subject: RE: media query, re Cermaq and sea lice

Hi [REDACTED]

I will look into it for you. Was there some sort of release about this?

Thanks,

Michelle

From: [REDACTED]

Sent: September-19-18 1:49 PM

To: RHQ - Media.PAC

Subject: media query, re Cermaq and sea lice

Good day.

My name is [REDACTED] reporter with the Globe and Mail.

I'm working on a story about Cermaq closing one of its sites, apparently in relation to sea lice concerns. (I haven't yet talked directly to the company but I have put in a request.)

I'm hoping to speak to someone at DFO about this development and about sea lice concerns in general.

My deadline to speak to someone is 4 pm Pacific time tomorrow – Thursday September 20.

I can be reached via email or at [REDACTED]

Thank you,

[REDACTED]



[REDACTED]

s.19(1)

Bate, Dan

From: Bate, Dan
Sent: September-21-18 12:33 PM
To: Rainer, Michelle
Subject: FW: media query, re Cermaq and sea lice

Good to go.. thanks

Dan

From: Antcliffe, Bonnie
Sent: September-21-18 11:59 AM
To: Bate, Dan
Cc: Girouard, Louise; Fogliato, Cara
Subject: RE: media query, re Cermaq and sea lice

Ok – this looks good then if it is the final

From: Bate, Dan
Sent: Friday, September 21, 2018 11:18 AM
To: Antcliffe, Bonnie <Bonnie.Antcliffe@dfo-mpo.gc.ca>
Cc: Girouard, Louise <Louise.Girouard@dfo-mpo.gc.ca>; Fogliato, Cara <Cara.Fogliato@dfo-mpo.gc.ca>
Subject: RE: media query, re Cermaq and sea lice

Yes, Andy approved, but we'd like to make a couple of tweaks.

From: Antcliffe, Bonnie
Sent: September-21-18 10:42 AM
To: Bate, Dan
Cc: Girouard, Louise; Fogliato, Cara
Subject: RE: media query, re Cermaq and sea lice

Is andy ok with these

From: Bate, Dan
Sent: Friday, September 21, 2018 9:19 AM
To: Antcliffe, Bonnie <Bonnie.Antcliffe@dfo-mpo.gc.ca>
Cc: Reid, Rebecca <Rebecca.Reid@dfo-mpo.gc.ca>; Girouard, Louise <Louise.Girouard@dfo-mpo.gc.ca>; Fogliato, Cara <Cara.Fogliato@dfo-mpo.gc.ca>
Subject: FW: media query, re Cermaq and sea lice

Hi Bonnie - understand you are A/RDG today.
Looking for your OK on the following media response.

s.19(1)

Thanks much,
Dan

Issue: [REDACTED] Globe and Mail [REDACTED] She is working on a story about Cermaq closing one of its sites, apparently in relation to sea lice concerns. She has already spoken to Cermaq and has a follow-up question for DFO:

Given the level of sea lice infestations in Clayoquot Sound this year, is DFO doing any additional monitoring or enforcement in the area?

Deadline: Friday, September 21 at 12:00 p.m.

Approved by: Zac Waddington, Adrienne Paylor, Andy Thomson

Media lines:

- Fisheries and Oceans Canada (DFO) is confident in the monitoring being done in the Clayoquot area by environmental non-government groups, and third party environmental consultants hired by Cermaq. For this reason, DFO determined that resources could be better directed to furthering research into SLICE resistance.
- DFO is keeping a close eye on the issue of SLICE resistance. The Department collected sea lice from Cermaq Canada's Bawden site in the Clayoquot area and sent them to the BC Centre for Aquatic Health Sciences for analysis, which confirmed SLICE resistance. Those lice were later sent to researchers at the Atlantic Veterinary College who are undertaking work to better understand the genetic basis for SLICE resistance.
- During most years, more than 90% of sites in BC are below the regulatory thresholds for sea lice during the wild salmon outmigration period (from March 1 to June 30 of each year). However, there were documented failures of SLICE treatment at Klemtu in 2015 and Esperanza Inlet in 2017 and now Clayoquot Sound in 2018.
- Research is under way, by DFO, industry, and academia, to find alternative methods to manage sea lice, and to better predict and track SLICE resistance. For instance, DFO is currently studying, or supporting research on, the use of Pacific perch as "cleaner fish" that eat sea lice off farmed fish and warm water baths to kill sea lice. More information on these projects can be found at www.dfo-mpo.gc.ca/aquaculture/sci-res/rd-eng.htm.
- DFO is also supporting the licensing and approval process for alternative sea lice treatments, which are a necessary part of an integrated pest management approach.

Dan Bate

Team Lead, Communications

Fisheries and Oceans Canada Pacific Region / Canadian Coast Guard / Government of Canada

Dan.Bate@dfo-mpo.gc.ca / Tel: (604) 775-8809 / Cell: [REDACTED]

Chef d'équipe, communications

Pêches et Océans Canada, région du Pacifique / Garde côtière canadienne / Gouvernement du Canada

Dan.Bate@dfo-mpo.gc.ca / Tél : (604) 775-8809 / Tél. cell. : [REDACTED]

From: [REDACTED]

Sent: September-19-18 1:49 PM

To: RHQ - Media.PAC

Subject: media query, re Cermaq and sea lice

s.16(2)(c)

s.19(1)

Good day.

My name is [REDACTED] reporter with the Globe and Mail.

I'm working on a story about Cermaq closing one of its sites, apparently in relation to sea lice concerns. (I haven't yet talked directly to the company but I have put in a request.)

I'm hoping to speak to someone at DFO about this development and about sea lice concerns in general.

My deadline to speak to someone is 4 pm Pacific time tomorrow – Thursday September 20.

I can be reached via email or at [REDACTED]

Thank you,



s.19(1)



No further information has been removed or severed from this page

Bate, Dan

From: Bate, Dan
Sent: September-21-18 12:44 PM
To: Stanek, Frank; Chow, Vance; Saindon, Carole; NCR Media RCN (DFO/MPO)
Cc: Hubley, Marian; Morris, Christina; Quinn, Caroline; Smith, Kathleen; Fagan, Ashley; Girouard, Louise; Rainer, Michelle; Saindon, Carole
Subject: RE: FYI: Globe and Mail, Cermaq and sea lice

Hi Frank - we have lines on SLICE (which we've incorporated), adapted them and added some local info which relates to the reporter's question.

D

From: Stanek, Frank
Sent: September-21-18 12:40 PM
To: Bate, Dan; Chow, Vance; Saindon, Carole; NCR Media RCN (DFO/MPO)
Cc: Hubley, Marian; Morris, Christina; Quinn, Caroline; Smith, Kathleen; Fagan, Ashley; Girouard, Louise; Rainer, Michelle; Saindon, Carole
Subject: Re: FYI: Globe and Mail, Cermaq and sea lice

Hi. Is the response essentially a reframing of existing material - messaging?

Frank

Sent from my BlackBerry 10 smartphone on the Rogers network.

From: Bate, Dan
Sent: Friday, September 21, 2018 3:35 PM
To: Stanek, Frank; Chow, Vance; Saindon, Carole; NCR Media RCN (DFO/MPO)
Cc: Hubley, Marian; Morris, Christina; Quinn, Caroline; Smith, Kathleen; Fagan, Ashley; Girouard, Louise; Rainer, Michelle
Subject: FYI: Globe and Mail, Cermaq and sea lice

Hi Frank/Vance - flagging up for info.
We propose we'll get back to the reporter by 3pm today unless you let us know otherwise.

Dan

Issue: [REDACTED] Globe and Mail ([REDACTED]) She is working on a story about Cermaq closing one of its sites, apparently in relation to sea lice concerns. She has already spoken to Cermaq and has a follow-up question for DFO:
Given the level of sea lice infestations in Clayoquot Sound this year, is DFO doing any additional monitoring or enforcement in the area?

Deadline: Friday, September 21 at 3:00 p.m.

Approved by: Zac Waddington, Adrienne Paylor, Andy Thomson, Bonnie Antcliffe (AR/DG Pacific)

Media lines:

- Fisheries and Oceans Canada (DFO) is confident in the monitoring being done in the Clayoquot area by environmental non-government groups, and third party environmental consultants hired by Cermaq. For this reason, DFO determined that resources could be better directed to furthering research into SLICE resistance.

- DFO is keeping a close eye on the issue of SLICE resistance. The Department collected sea lice from Cermaq Canada's Bawden site in the Clayoquot area and sent them to the BC Centre for Aquatic Health Sciences for analysis, which confirmed SLICE resistance. Those lice were later sent to researchers at the Atlantic Veterinary College who are undertaking work to better understand the genetic basis for SLICE resistance.
- During most years, more than 90% of sites in BC are below the regulatory thresholds for sea lice during the wild salmon outmigration period (from March 1 to June 30 of each year). However, there were documented failures of SLICE treatment at Klemtu in 2015 and Esperanza Inlet in 2017 and now Clayoquot Sound in 2018.
- Research is under way, by DFO, industry, and academia, to find alternative methods to manage sea lice, and to better predict and track SLICE resistance. For instance, DFO is currently studying, or supporting research on, the use of Pacific perch as "cleaner fish" that eat sea lice off farmed fish and warm water baths to kill sea lice. More information on these projects can be found at www.dfo-mpo.gc.ca/aquaculture/sci-res/rd-eng.htm.
- DFO is also supporting the licensing and approval process for alternative sea lice treatments, which are a necessary part of an integrated pest management approach.

Dan Bate

Team Lead, Communications

Fisheries and Oceans Canada Pacific Region / Canadian Coast Guard / Government of Canada

Dan.Bate@dfo-mpo.gc.ca / Tel: (604) 775-8809 / Cell: [REDACTED]

Chef d'équipe, communications

Pêches et Océans Canada, région du Pacifique / Garde côtière canadienne / Gouvernement du Canada

Dan.Bate@dfo-mpo.gc.ca / Tél : (604) 775-8809 / Tél. cell. : [REDACTED]

From: [REDACTED]

Sent: September-19-18 1:49 PM

To: RHQ - Media.PAC

Subject: media query, re Cermaq and sea lice

Good day.

My name is [REDACTED] reporter with the Globe and Mail.

I'm working on a story about Cermaq closing one of its sites, apparently in relation to sea lice concerns. (I haven't yet talked directly to the company but I have put in a request.)

I'm hoping to speak to someone at DFO about this development and about sea lice concerns in general.

My deadline to speak to someone is 4 pm Pacific time tomorrow – Thursday September 20.

I can be reached via email or at [REDACTED]

Thank you,

[REDACTED]



[REDACTED]

s.16(2)(c)

s.19(1)

Bate, Dan

From: Bate, Dan
Sent: September-21-18 2:05 PM
To: Rainer, Michelle
Subject: FW: FOR INFORMATION: Media query - Sea Lice - Globe and Mail

Good to go thanks Michelle.

Dan

From: Lubczuk, Jocelyn
Sent: September-21-18 2:04 PM
To: Chow, Vance; Des Rosiers, Marie-Pascale
Cc: Mitchell, Laura; Young, George; O'Grady, Samantha; Tran, Thi; Choeurng, Stephanie; Windsor, Victoria; Knudsen, Mark; Kahn, Zoe; Jarjour, Jasmine; Khwaja, Saba; Butcher, Ashley; Turple, Justin; Belle-Isle, Alain; Snow, Lindsey; Hubley, Marian; McElhone, Kathryn; Morris, Christina; Smith, Kathleen; Fagan, Ashley; Seguin, Natalie; Girouard, Louise; Bate, Dan; Rainer, Michelle; Quinn, Caroline; Stanek, Frank; Saindon, Carole; Mayrand, Benoit; Sankey, Lauren; Eatmon, Keegan; NCR Media RCN (DFO/MPO)
Subject: Re: FOR INFORMATION: Media query - Sea Lice - Globe and Mail

No concerns. Thanks!

Jocelyn Lubczuk
Press Secretary
Fisheries, Oceans and the Canadian Coast Guard
Jocelyn.lubczuk@dfo-mpo.gc.ca

Sent from my BlackBerry... please excuse typos

From: Chow, Vance
Sent: Friday, September 21, 2018 5:01 PM
To: Des Rosiers, Marie-Pascale; Lubczuk, Jocelyn
Cc: Mitchell, Laura; Young, George; O'Grady, Samantha; Tran, Thi; Choeurng, Stephanie; Windsor, Victoria; Knudsen, Mark; Kahn, Zoe; Jarjour, Jasmine; Khwaja, Saba; Butcher, Ashley; Turple, Justin; Belle-Isle, Alain; Snow, Lindsey; Hubley, Marian; McElhone, Kathryn; Morris, Christina; Smith, Kathleen; Fagan, Ashley; Seguin, Natalie; Girouard, Louise; Bate, Dan; Rainer, Michelle; Quinn, Caroline; Stanek, Frank; Saindon, Carole; Mayrand, Benoit; Sankey, Lauren; Eatmon, Keegan; NCR Media RCN (DFO/MPO)
Subject: FOR INFORMATION: Media query - Sea Lice - Globe and Mail

FYI Jocelyn,

Pls see the media response below from Pac region for the Globe and Mail, regarding sea lice. Messaging is operational and factual.

If any concerns pls advise by 6:00 pm ET (3:00 pm Pacific).

Thanks,
Vance

s.16(2)(c)

Issue: [REDACTED] Globe and Mail [REDACTED] She is working on a story about Cermaq closing one of its sites, apparently in relation to sea lice concerns. She has already spoken to Cermaq and has a follow-up question for DFO:

Given the level of sea lice infestations in Clayoquot Sound this year, is DFO doing any additional monitoring or enforcement in the area?

Deadline: Friday, September 21 at 3:00 p.m.

Approved by: Zac Waddington, Adrienne Paylor, Andy Thomson, Bonnie Antcliffe (A/RDG Pacific), shared FYI for awareness with JF LaRue, Philippe Morel, Wayne Moore and Arran McPherson

Media lines:

- Fisheries and Oceans Canada (DFO) is confident in the monitoring being done in the Clayoquot area by *environmental non-government groups, and third party environmental consultants* hired by Cermaq. For this reason, DFO determined that resources could be better directed to furthering research into SLICE resistance.

(SLICE is approved for use in Canada as an in-feed therapeutant used by the salmon aquaculture industry to manage sea lice. It can only be administered to farmed fish under veterinary prescription).

- DFO is keeping a close eye on the issue of SLICE resistance. The Department collected sea lice from Cermaq Canada's Bawden site in the Clayoquot area and sent them to the BC Centre for Aquatic Health Sciences for analysis, which confirmed SLICE resistance. Those lice were later sent to researchers at the Atlantic Veterinary College who are undertaking work to better understand the genetic basis for SLICE resistance.
- During most years, more than 90% of sites in BC are below the regulatory thresholds for sea lice during the wild salmon outmigration period (from March 1 to June 30 of each year). However, there were documented failures of SLICE treatment at Klemtu in 2015 and Esperanza Inlet in 2017 and now Clayoquot Sound in 2018.
- Research is under way, by DFO, industry, and academia, to find alternative methods to manage sea lice, and to better predict and track SLICE resistance. For instance, DFO is currently studying, or supporting research on, the use of Pacific perch as "cleaner fish" that eat sea lice off farmed fish and warm water baths to kill sea lice. More information on these projects can be found at www.dfo-mpo.gc.ca/aquaculture/sci-res/rd-eng.htm
- DFO is also supporting the licensing and approval process for alternative sea lice treatments, which are a necessary part of an integrated pest management approach.

s.19(1)

Rainer, Michelle

From: Rainer, Michelle
Sent: September-21-18 3:47 PM
To: [REDACTED]
Subject: Response from DFO

Hi [REDACTED]

Sorry for the delay; please find response below.

Fisheries and Oceans Canada (DFO) is confident in the monitoring being done in the Clayoquot area by environmental non-government groups, and third party environmental consultants hired by Cermaq. For this reason, DFO determined that resources could be better directed to furthering research into SLICE resistance (SLICE is approved for use in Canada as an in-feed therapeutant used by the salmon aquaculture industry to manage sea lice. It can only be administered to farmed fish under veterinary prescription).

DFO is keeping a close eye on the issue of SLICE resistance. The Department collected sea lice from Cermaq Canada's Bawden site in the Clayoquot area and sent them to the BC Centre for Aquatic Health Sciences for analysis, which confirmed SLICE resistance. Those lice were later sent to researchers at the Atlantic Veterinary College who are undertaking work to better understand the genetic basis for SLICE resistance.

During most years, more than 90% of sites in BC are below the regulatory thresholds for sea lice during the wild salmon outmigration period (from March 1 to June 30 of each year). However, there were documented failures of SLICE treatment at Klemtu in 2015 and Esperanza Inlet in 2017 and now Clayoquot Sound in 2018.

Research is under way, by DFO, industry, and academia, to find alternative methods to manage sea lice, and to better predict and track SLICE resistance. For instance, DFO is currently studying, or supporting research on, the use of Pacific perch as "cleaner fish" that eat sea lice off farmed fish and warm water baths to kill sea lice. More information on these projects can be found at www.dfo-mpo.gc.ca/aquaculture/sci-res/rd-eng.htm. DFO is also supporting the licensing and approval process for alternative sea lice treatments, which are a necessary part of an integrated pest management approach.

Kind regards,

Michelle Rainer

Communications Advisor | Conseillère en communications

Fisheries and Oceans Canada | Pêches et Océans Canada

200 - 401 Burrard Street, Vancouver, B.C. V6C 3S4 | 200 - 401 rue Burrard, Vancouver, C.-B. V6C 3S4

Telephone | Téléphone 604-775-5065

s.19(1)

Waddington, Zac

From: McNabb, Melanie
Sent: September-25-18 1:10 PM
To: Waddington, Zac
Cc: Manchester, Howie
Subject: RE: Fish health briefing for managers
Attachments: MMR Sept 2018.pdf

Very funny. Just checking!

Here's the final product. Hopefully we'll get some feedback after the meeting as to whether this is what they had in mind.

Cheers,
Mel

Melanie McNabb
Governance Coordinator / Coordinatrice de la gouvernance
Fisheries and Oceans Canada, Pacific Region / Pêche et Océans Canada, région du pacifique
200 - 401 rue Burrard St , Vancouver, BC V6C 3S4
Tel. / tél.: (604) 666-6894
Fax / téléc.: (604) 666-1076
e-mail / courriel : melanie.mcnabb@dfo-mpo.gc.ca

From: Waddington, Zac
Sent: September-25-18 1:04 PM
To: McNabb, Melanie
Subject: RE: Fish health briefing for managers

- Roger that. Clayoquot doesn't have the opposable thumbs necessary to do that.

Zac

From: McNabb, Melanie
Sent: September-25-18 12:37 PM
To: Waddington, Zac
Cc: Manchester, Howie
Subject: RE: Fish health briefing for managers

:Thanks Zac! Should this say "~~Clayoquot~~ Cermaq has harvested out all of its northern sites...."

Melanie McNabb
Governance Coordinator / Coordinatrice de la gouvernance
Fisheries and Oceans Canada, Pacific Region / Pêche et Océans Canada, région du pacifique
200 - 401 rue Burrard St , Vancouver, BC V6C 3S4
Tel. / tél.: (604) 666-6894
Fax / téléc.: (604) 666-1076
e-mail / courriel : melanie.mcnabb@dfo-mpo.gc.ca

From: Waddington, Zac
Sent: September-25-18 12:14 PM
To: McNabb, Melanie
Cc: Manchester, Howie
Subject: RE: Fish health briefing for managers

Please chime in Howie if I say anything incorrect below.

The number of mortality events in this period as compared to past years is high. Due to our biomass threshold in our licence for ME's, we are having numerous ongoing ME's as a result of large fish (5.5-6 kg) dying at harvest due to low DOs, Harmful Algal Blooms, [REDACTED]

[REDACTED] The late summer seems to have had more issues with HAB (harmful algal blooms), and low DO's than would be typical for this time of year. Warmer water temperatures, and decreased rainfall and runoff are suspect causes. Simon Jones is currently undertaking research with industry to try and better understand [REDACTED]

Clayoquot has harvested out all of its northern sites, and began to re-enter smolts into the sites fallowed longest (~3 months), beginning in early September. All fish that have been re-stocked into Clayoquot have received the in-feed treatment with Imvixa in the hatchery. This provides ~6-9 months of sea lice control. The hydrolicer Cermaq is having built in Norway is scheduled to arrive Feb-March 2019.

Numerous sites in Nootka (Hecate, Esperanza and Steamer), had high lice levels in July and into August. Unfortunately warm water temperatures prevented the use of hydrogen peroxide. And the fish were off feed for most of July and August due to HAB and warm temperatures and therefore could not receive SLICE treatment. SLICE treatment occurred at the end of August.

Let me know if you need anything else,

Zac

From: McNabb, Melanie
Sent: September-25-18 10:12 AM
To: Waddington, Zac
Cc: Manchester, Howie
Subject: FW: Fish health briefing for managers

Hi Zac,

I've taken the data from Howie's summary (thanks Howie!) and included it in the monthly managers' report:

s.20(1)(b)



September 2018



Marine Finfish

- Benthic audits are complete for the year - target of 20% of active farms achieved (exceeded).
- No unusual incidental catch reporting lately. Herring continues to be 80-90% of wild fish killed at farms
- No unusual mammal incidents or mortality lately. Kerra is meeting with industry in October to discuss some new ideas for reducing mammal mortality.
- No new escape events



Special Projects

- MAFeo partnering with Science on 3 projects

Fish Health

Q3 activities and results (July 1-Sept)

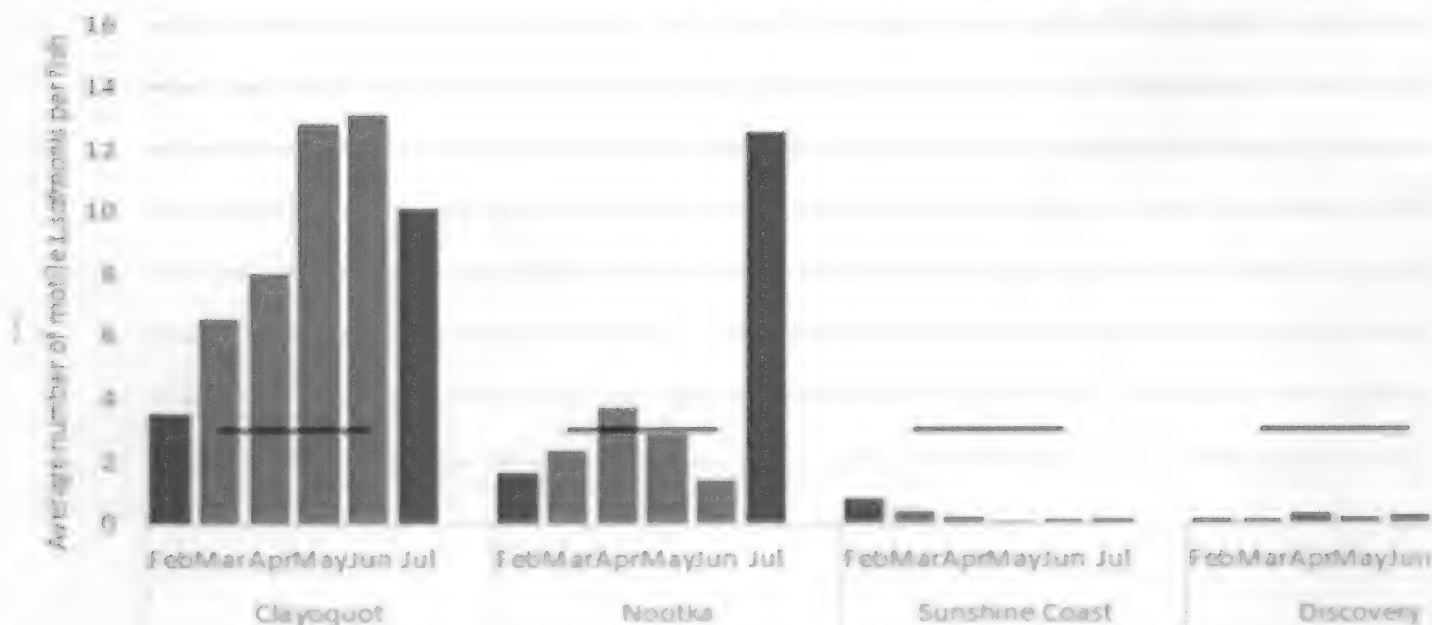
- Number of audits completed to date
- Number of fish sampled = 197
- Number of Mortality Events: 17
 - Harmful Algae = 5
 - Low O2 = 7
 - Low O2 & Harmful Algae = 1
 - Handling = 2
 - Gill Health Issues = 2
- Number of Fish Health Events: 6
 - Vet diagnosis: sea lice = 4
 - Vet diagnosis: poor conditioning =
 - Vet diagnosis: mouth rot = 1

If you have time do do a quick analysis, what I'd like to include is:

- Are the #s of mortality events and fish health events typical?
- Any unusual or worrisome findings?

Krista also provided me with the zone level SL graph. It's quite apparent that the Clayoquot sites are continuing to experience SL challenges. Could you provide a sentence or two on resistance in the area and the mitigation plans that you are working on with the companies operating in the area? I also see the spike in Nooka in July after relatively low numbers during the spring. Is there any explanation for that? And were actions taken to reduce the levels in subsequent weeks?

Sea Lice Abundance at BC Salmon Farms



Thanks so much,
Mel

Melanie McNabb
Governance Coordinator / Coordinatrice de la gouvernance
Fisheries and Oceans Canada, Pacific Region / Pêche et Océans Canada, région du pacifique
200 - 401 rue Burrard St., Vancouver, BC V6C 3S4
Tel. / tél.: (604) 666-6894
Fax / téléc.: (604) 666-1076
e-mail / courriel : melanie.mcnabb@dfo-mpo.gc.ca

From: Manchester, Howie
Sent: September-24-18 11:25 AM
To: McNabb, Melanie
Cc: Paylor, Adrienne
Subject: FW: Fish health briefing for managers

Hi Melanie,

Just for your information, I forwarded the above fish health summary tables to Zac. His plan is to do a brief summary from this information for the manager meeting, I'm hoping he has time to do this but if not you can let the manager know the plan. Please note that the third table is strictly from the field audit information, in most cases the lab reports are not available yet and no diagnosis has been made at this time.

My feeling (and I think Zac's as well) was that the tables I prepared were too detailed for the Managers briefing and that they would prefer a written summary.

Thanks
Howie

From: Manchester, Howie
Sent: September-21-18 11:37 AM
To: Waddington, Zac

Cc: Diamond, Maria

Subject: Fish health briefing for managers

Hi Zac,

Here is a summary of FHE, ME and our FH audits. Hopefully from this you can prepare a brief summary for the managers.

I've indicated how many FHE and ME since August 1 to September 14. I've included a brief summary table of our fish health field audits for quarter 3 (since July 1), including number completed to date and how many carcasses we have sampled so far, we only have two more audits to complete the quarter.

I've highlighted in yellow events that were significant. I've also indicated the sea lice status as far as I could tell (mostly august) but I believe Krista has a summary of sea lice status prepared for the managers.

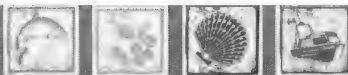
Please let me know if you have any questions, this is rough but hopefully going forward we can have a cleaner version of these summaries, especially the FHE and ME.

Thanks

Howie

Howie Manchester BSc
Senior Aquatic Science Biologist
Fisheries and Oceans Canada / Pêches et Océans Canada
Aquaculture Management Division / Gestion de l'aquaculture
Aquaculture Environmental Operations - Fish Health
#103 2435 Mansfield Drive
Courtenay, B.C
Telephone | Téléphone: 250 703 0916 | Cell: [REDACTED]
Fax: 250 703 0921

s.16(2)(c)



September 2018



Marine Finfish

- Benthic audits are complete for the year - target of 20% of active farms achieved (exceeded).
- No unusual incidental catch reporting lately. Herring continues to be 80-90% of wild fish killed at farms
- No unusual mammal incidents or mortality lately. Kerra is meeting with industry in October to discuss some new ideas for reducing mammal mortality.
- No new escape events



Special Projects

- MAFeo partnering with Science on 3 projects this year:
 - 1) 2/3 through the national "far fields effects" project
 - 2) Work planned for October on "UV sulphide monitoring" or alternative sulphide monitoring project
 - 3) e-DNA project finished for the year
- MAFeo also assisting with a monitoring project in Comox and Campbell River harbours to test for metal levels for contaminated sites (work planned for November)
- Wild Fish Predation Project – ongoing. Spring, Summer and Fall were done in 2017. Winter, Spring, Summer done for 2018, moving into Fall sampling. Wild fish predation continues to be ~0.1% of the 10,400 fish examined.

Fish Health



Q3 audits (July 1-September 14)

- Number of audits completed to date = 28
- Number of fish sampled = 197

Mortality & Fish Health Events (Aug 1-September 14)

- Number of Mortality Events: 17
 - Harmful Algae = 5
 - Low O2 = 7
 - Low O2 & Harmful Algae = 1
 - Handling = 2
 - Gill Health Issues = 2
- Number of Fish Health Events: 6
 - Vet diagnosis: sea lice = 4
 - Vet diagnosis: poor conditioning = 1
 - Vet diagnosis: mouth rot = 1

The number of mortality events in this period as compared to past years is high. Due to our biomass threshold in CoLs, we are having numerous ongoing ME's as a result of large fish (5.5-6 kg) dying at harvest due to low DOs, Harmful Algal Blooms (HABs), and ongoing gill health issues.

The late summer seems to have had more issues with HAB, and low DOs than would be typical for this time of year. Warmer water temperatures and decreased rainfall and runoff are suspect causes. Simon Jones is currently undertaking research with industry to try and better understand

-1-



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September 2018

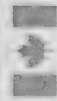


Sea Lice Abundance at BC Salmon Farms - February to July 2018



Cermaq has harvested out all of its northern sites, and began to re-enter smolts into the sites followed longest (~3 months) in early September. All fish that have been re-stocked into Clayoquot have received the in-feed treatment with Imvixa in the hatchery. This provides ~6-9 months of sea lice control. The hydrolicer Cermaq is having built in Norway is scheduled to arrive February-March 2019.


Numerous sites in Nootka (Hecate, Esperanza and Steamer), had high lice levels in July and into August. Unfortunately warm water temperatures prevented the use of hydrogen peroxide. As the fish were off feed for most of July and August due to Harmful Algal Blooms and warm temperatures, SLICE treatment could not occur until the end of August.




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Data Management & Reporting

- 2 media enquiries from the Star Vancouver & CBC re: 'Namgis/Morton litigation.
- 1 call from the Star Vancouver re: the UBCM resolution urging the province to transition to closed containment systems.
- 1 call from Aquaculture North America re: Minister's vision for aquaculture and his views on the issues facing the industry.
- The Comox Valley Record and Chek news covered the Big Beach Clean-up
- CAIA annual conference – Nov. 27-28, Ottawa:
<http://www.aquaculture.ca/farmed-seafood-policy-conference-2018>



Media & Events

- SF Annual Report to be complete by November 30
- FHAS Database options document to be provided to DFO by November 30
- Inaugural bi-weekly AQUIS WG meeting October 11
- I&T System in production and Version 1.1.1 in testing, aiming to have new build in Production by end of September
- AQUIS Environmental Modules (Version 3.2.1)
 - new build in Production by end of September




2018 Big Beach Clean-up


Big Beach Clean-up 2018 ran from September 14-22, and was organized in collaboration with the BC Shellfish Growers Association, expanding on the existing clean-up event led by the Denman Island stewardship group.

Highlights:

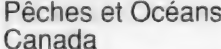
- 195 total volunteers
- 50km of shoreline cleaned- Mansfield Drive at the estuary (Courtenay AEO office) to Deep Bay
- 60 cubic yards of debris collected= 2000kg
- 1 transport truck of plastic, poly rope and Styrofoam sent to Ocean Legacy for recycling




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Higgins, Mark

From: Kennedy, Eddy
Sent: September-25-18 4:17 PM
To: Johnson, Stewart; Sutherland, Terri; Therriault, Thomas; O, Miriam; Coyle, Theraesa; Pearce, Chris; King, Jackie; Robinson, Cliff; Hyatt, Kim; Neville, Chrys
Cc: Higgins, Mark; Dickie, Catherine
Subject: FW: Aquaculture Risk Management Framework and the Application of the Precautionary Approach
Attachments: Application of the Precautionary Approach Within a Risk Management Frame....docx
Importance: High

Dear all,
Please find attached a doc on which we are looking for comment. See below for further details. If you can pass any comments that you have onto Mark Higgins (Cc'd) by end of this week, it would be appreciated. It is a short document. If you need more time, please let Mark know.
Note that there may be a call/meeting to discuss next week, but that is still to be confirmed.

Thanks
Eddy

From: Lowe, Carmel
Sent: September-19-18 12:05 PM
To: Higgins, Mark; Holmes, John; Kennedy, Eddy
Cc: MacDougall, Lesley; Houston, Kim; Patten, Bruce
Subject: FW: Aquaculture Risk Management Framework and the Application of the Precautionary Approach
Importance: High

All – see below and attached.

Mark – I would like you engage the others on this email and provide me with a list of the staff that should be included in a review of this draft approach. I propose we then convene a meeting of those staff and those on this email to conduct the review and provide a consolidated response back to Jay and Ingrid. Let me know if there are any issues/concerns with this proposed approach – and if so, what are alternate suggestions completing the review.

I will ask Catherine to find a time for this regional review meeting during first week of October. I am guessing we will require 2 hours.

Carmel

Carmel Lowe, Ph.D.
Regional Director Science | Directrice régionale des sciences
Fisheries and Oceans Canada | Pêches et Océans Canada
Pacific Biological Station | Station biologique du Pacifique
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From: Parsons, Jay

Sent: September 19, 2018 11:48 AM

To: McCallum, Barry <Barry.McCallum@dfo-mpo.gc.ca>; Vézina, Alain <Alain.Vezina@dfo-mpo.gc.ca>; Bliss, Doug <Doug.Bliss@dfo-mpo.gc.ca>; de Lafontaine, Yves <Yves.deLafontaine@dfo-mpo.gc.ca>; Wang, Sen <Sen.Wang@dfo-mpo.gc.ca>; Lowe, Carmel <Carmel.Lowe@dfo-mpo.gc.ca>; Laverdure, Louise <Louise.Laverdure@dfo-mpo.gc.ca>
Cc: McPherson, Arran <Arran.McPherson@dfo-mpo.gc.ca>; Moore, Wayne <Wayne.Moore@dfo-mpo.gc.ca>; Burgetz, Ingrid <Ingrid.Burgetz@dfo-mpo.gc.ca>; Davis, Ben <Ben.Davis@dfo-mpo.gc.ca>; Meade, James <James.Meade@dfo-mpo.gc.ca>; Sullivan, Mike DJ <Mike.Sullivan@dfo-mpo.gc.ca>; Blair, Tammy <Tammy.Blair@dfo-mpo.gc.ca>; Cooper, Lara <Lara.Cooper@dfo-mpo.gc.ca>; Paul, Stacey D <Stacey.Paul@dfo-mpo.gc.ca>; MacKinnon, Anne-Margaret <Anne-Margaret.MacKinnon@dfo-mpo.gc.ca>; Ouellette, Marc <Marc.Ouellette@dfo-mpo.gc.ca>; Pomerleau, Corinne <Corinne.Pomerleau@dfo-mpo.gc.ca>; Mckindsey, Chris <Chris.Mckindsey@dfo-mpo.gc.ca>; Christie, Gavin C <Gavin.Christie@dfo-mpo.gc.ca>; Geiling, Doug <Doug.Geiling@dfo-mpo.gc.ca>; Kennedy, Eddy <Eddy.Kennedy@dfo-mpo.gc.ca>; Higgins, Mark <Mark.Higgins@dfo-mpo.gc.ca>; White, Andrea <Andrea.White@dfo-mpo.gc.ca>; Pilcher, Scott <Scott.Pilcher@dfo-mpo.gc.ca>

Subject: Aquaculture Risk Management Framework and the Application of the Precautionary Approach

Importance: High

Le français suit

Colleagues,

As mentioned Monday, a draft Aquaculture Risk Management Framework/Application of the Precautionary Approach has recently been developed, in response to the Minister's request that the Department explain how aquaculture is managed and how the precautionary approach is applied. This supports a number of high profile and public expectations, including the Cohen Commission report, the Minister's mandate letter and the Spring 2018 report from the Commissioner for the Environment and Sustainable Development.

It is important to note that this document is very much still a work in progress. For example, the intention is to balance this document nationally by including additional examples in Annex 2 incorporating east coast applications.

Prior to engaging with the Provinces, Territories and Indigenous Peoples, comments and feedback internally is being sought. Aquaculture Management sent out a version Tuesday to their RDs seeking their comments on the applicability of the framework to aquaculture, and changes and/or improvements.

The attached version is the most recent and current version and should be used for the purpose of review. Unfortunately, it is currently only available in English; the translated version will be sent when it becomes available.

Aquaculture Management has requested feedback by **Friday October 12, 2018**. Therefore, the comments from EOS will also need to be submitted by that time as well.

We ask that you broadly engage the DFO Science community within your region (i.e., in addition to aquaculture staff, also fisheries science and habitat science staff, etc.).

Please send your collated comments, corrections and suggestions to Ingrid Burgetz and Jay Parsons, with a cc to Wayne Moore by October 12th. Ingrid and Ed Porter from Aquaculture Management will then integrate all the comments into the next version. As well, we have been asked to convene a departmental technical review meeting of the document with internal (Science and Management) and external experts. We will soon be approaching you for suggested regional participants (Aquaculture / Fisheries / Habitat Science). This will also be an additional or alternate approach to providing regional input into the document.

Next steps following this include:

- DFO finalization of the document for external consultation, including presentation to the Minister
- DFO Science & Management internal and external technical review (details to be shared shortly)
- Consultations with P/T through the Canadian Council of Fisheries and Aquaculture Ministers
- Industry consultation
- Indigenous consultations
- Public consultation (on DFO website)
- Final posting on DFO's website

Thank you very much to your collaboration and support.

I apologize for the tight timelines, but this file has the express interest of the Minister.

Chers collègues,

Comme mentionné lundi, une ébauche du cadre de gestion des risques liés à l'aquaculture et de l'application de l'approche de précaution a récemment été élaborée en réponse à la demande du ministre voulant que le Ministère explique la façon dont l'aquaculture est gérée et dont l'approche de précaution est appliquée. Cela appuie un certain nombre d'attentes publiques de premier plan, y compris le rapport de la Commission Cohen, la lettre de mandat du ministre ainsi que le rapport publié par la commissaire à l'environnement et au développement durable au printemps 2018.

Il est important de mentionner que ce document est loin d'être définitif. Par exemple, pour que ce document soit équilibré à l'échelle nationale, nous souhaitons inclure à l'annexe 2 d'autres exemples d'application sur la côte est.

Avant de collaborer avec les provinces, les territoires et les peuples autochtones, nous désirons d'abord obtenir des commentaires à l'interne. Mardi, l'équipe de la Gestion de l'aquaculture a envoyé une version du document à ses directeurs régionaux afin d'obtenir leurs commentaires sur l'applicabilité du cadre à l'aquaculture, ainsi que des suggestions de modifications ou d'améliorations, le cas échéant.

Vous trouverez ci-joint la version la plus récente sur laquelle vous devez vous baser pour effectuer votre examen. Malheureusement, elle n'est disponible qu'en anglais pour le moment; vous recevrez la version traduite dès qu'elle sera prête.

L'équipe de la Gestion de l'aquaculture a demandé que les commentaires soient fournis d'ici le vendredi 12 octobre 2018. Les commentaires des Sciences des écosystèmes et des océans doivent donc aussi être soumis d'ici cette date.

Nous vous demandons de mobiliser, en plus de votre personnel d'aquaculture, la communauté scientifique de Pêches et Océans Canada (MPO) de votre région (le personnel scientifique des pêches et de l'habitat, etc.).

Veuillez envoyer vos commentaires, vos corrections et vos suggestions à Ingrid Burgetz et Jay Parsons, avec copie conforme à Wayne Moore, d'ici le 12 octobre. Ingrid et Ed Porter de l'équipe de la Gestion de l'aquaculture intégreront par la suite tous les commentaires reçus dans la prochaine version. De plus, on nous a demandé de convoquer une réunion d'examen technique du document avec des experts internes (scientifiques et gestionnaires) et externes. Nous vous contacterons bientôt pour des participants régionaux (Science de l'aquaculture des pêches ou de l'habitat). Ce sera également une approche supplémentaire ou alternative pour fournir une contribution régionale au document.

Par la suite, les prochaines étapes seront les suivantes :

- Le MPO finalisera le document aux fins de consultation externe et de présentation au ministre.

- Les équipes des sciences et de la direction du MPO effectueront un examen technique interne et externe du document (les détails seront fournis sous peu).
- Des consultations seront menées auprès des provinces et territoires par l'intermédiaire du Conseil canadien des ministres des pêches et de l'aquaculture.
- L'industrie sera consultée.
- Les peuples autochtones seront consultés.
- Le grand public sera consulté (par l'entremise du site Web du MPO).
- La version définitive du document sera affichée sur le site Web du MPO.

Je vous remercie grandement pour votre collaboration et votre soutien.

Je tiens à m'excuser pour les délais serrés, mais ce dossier est d'un grand intérêt pour le ministre.

Jay

On behalf of SRS and EOSS

Jay Parsons, PhD

Director

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Application of the Precautionary Approach within a Risk Management Framework for Aquaculture

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Introduction

Globally, aquaculture continues to grow faster than other major food production sector, and has been identified by the FAO, as a critical contributor to food, nutrition and employment in the global economy.¹ The Government of Canada recognizes aquaculture's significant benefits to society, including providing full-time jobs in coastal Canada. In Canada, aquaculture is a relatively new industry and is jointly managed by the federal and provincial governments. There is tremendous potential for the Canadian industry to become an even greater player in overall world production. However, societal conflicts over which human activities are acceptable in Canadian waterbodies have created challenges to the growth and sustainability of aquaculture in Canada. This is often expressed as environmental sustainability concerns, ranging from direct environmental impacts to indirect impacts on wild fish health and productivity. A well-defined risk management framework, which embodies a clear understanding of unacceptable harm, taking precautionary steps where relevant and fully engaging the public throughout the entire risk-management process can help to clearly communicate where there are environmental risks, and can address both environmental sustainability issues and public concerns.

Fisheries and Oceans Canada's (DFO) mandate relates to the conservation of fish and fish habitat. This applies equally to fisheries as it does to decisions related to aquaculture. The starting point for any decisions made by DFO regarding human activities around waterbodies in Canada, including aquaculture, is founded on three key pieces of federal legislation: the *Fisheries Act*, the *Oceans Act* and the *Species at Risk Act*. Consequently, in executing the Department's fiduciary duty, the conservation of fish and fish habitat requires the conservation of biodiversity within the ecosystem, and the habitat and productivity of fish species. Given the complexity of detecting or monitoring biodiversity or productivity, proxies are used as practical measures for managing the environment. Therefore, the threshold for unacceptable harm to fish or fish habitat is any activity that has the potential to cause a population-level effect to fish species.

In addition, there are international commitments and best practices that are relevant to the management of activities. The Rio Declaration of the UN Conference on Environment and Development (UNCED) supports the right of sovereign states to pursue responsible economic development opportunities as long as other member states or future generations are not negatively impacted by such developments. The notion of the Precautionary Approach (PA) is geared towards large-scale threats, especially when the consequences are serious or irreversible (e.g., climate change).

Many governments apply the precautionary principle as part of an overall risk management framework to activities that may not potentially result in large-scale or permanent environmental impacts, but may be activities that have societal concern. It is within this context, that DFO applies precaution as required in delivering its regulatory and legislative responsibilities for aquaculture.

¹ FAO - The State of World Fisheries and Aquaculture 2018

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The following risk management framework for aquaculture is consistent with the overarching Sustainable Fisheries Framework. It also builds on the 2008 Aquaculture Policy Framework (APF) and specific policies developed to support DFO's B.C. Aquaculture Regulatory Program (BCARP).

Moreover, this Framework is not meant to create any new legal obligations to apply precaution. DFO's role in regulating the aquaculture sector is fundamentally linked to and is consistent with the overarching Sustainable Fisheries Framework. (SFF). The SFF provides the foundation for an ecosystem-based and precautionary approach to fisheries management in Canada, and provides the basis for ensuring Canadian fisheries are conducted in a manner which support conservation and sustainable use. Ultimately, through integration with the broader SFF, the residual effects of aquaculture on fish and fish habitat, following all mitigative actions, ensures that these effects can be taken into account in the sustainable management of fisheries.

DFO'S Approach to Aquaculture Management

Aquaculture Management Objectives

The overarching departmental aquaculture management objective is to create the conditions for a successful and sustainable aquaculture industry across Canada. Within the overall objective, the department's goal for aquaculture is to ensure that fish and their habitats are protected using regulatory mitigation, monitoring and compliance approaches that are efficient, effective and aligned with the potential risk to the environment, and integrated (to the extent possible) with broader fisheries management approaches. Specifically, the **threshold for unacceptable harm to fish or fish habitat is any activity that has the potential to cause a population-level effect to fish species**. Recognizing that aquaculture is managed federally and by provincial and territorial governments, the department's overall assessment of risk will consider risk management and mitigation measures by all regulatory partners.

An Ecosystem and Precautionary Approach

Ecosystem approaches recognize that humans are part of, and have significant influences on, their environments. In aquaculture management under an ecosystem approach—as in fisheries management more broadly—regulatory decisions consider the impact of human activities on fish species, habitats, and the ecosystem of which these species are a part, and take into account broad ecosystem changes related to weather and climate. While it is recognized that all habitats, species, populations and communities play a role in aquatic ecosystems, some are more important from an ecological perspective and some are more resilient than others.²

DFO incorporates a precautionary approach within its ecosystem approach to fisheries management decision-making, supporting the economic use of resources while ensuring that

² *Principles of Ecosystem Based Fisheries Management*: <http://www.dfo-mpo.gc.ca/fm-gp/peches-fisheries/fish-ren-peche/sff-cpd/ecosys-back-fiche-eng.htm>.

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potential risks to aquatic environments are managed to prevent harm to fish populations and habitat, and to limit other less serious harm to the extent feasible given available technology and costs. Management decisions are more cautious when scientific information is uncertain, unreliable or less complete.³

Implementing an Ecosystem Approach in Aquaculture

An efficiently and effectively applied ecosystem approach for managing aquaculture in Canada includes risk management that considers environmental impacts holistically to enable the evaluation of ecosystem level impacts. This integrated strategy is supported through a risk management framework. The holistic evaluation of impacts is supported by the use of the Pathways of Effects (PoE) model for aquaculture (see next section).

Taken as a whole, this approach is designed to support the consistent regulatory management of related aquaculture activities while identifying location, species or operational-specific factors that may influence the extent of the impact on the environment in a particular situation.

Aquaculture Environmental Risk Management

There are five major elements in the Department's approach to managing the environmental risks that may arise due to aquaculture activities (Figure 1, below).

- (1) Defining the environmental and ecosystem objectives for aquaculture activities in Canada: these objectives are defined within legislation, through intergovernmental and international agreements, and consideration of societal values;
- (2) Issue identification: these can be identified through the results of scientific research, monitoring of environmental changes, and/or through public engagement;
- (3) Risk assessment: the science-based characterization of the likelihood and consequence of an activity and assessment of the overall risk, based on the current state of knowledge, and, the identification of uncertainty;
- (4) Risk management: this includes the assessment of how to address uncertainties through applying precaution measures and options for regulatory measures (mitigation and compliance/effects monitoring), and management decisions on mitigation, monitoring, and licencing; and,
- (5) Monitoring and evaluation of the activity against the identified risks.

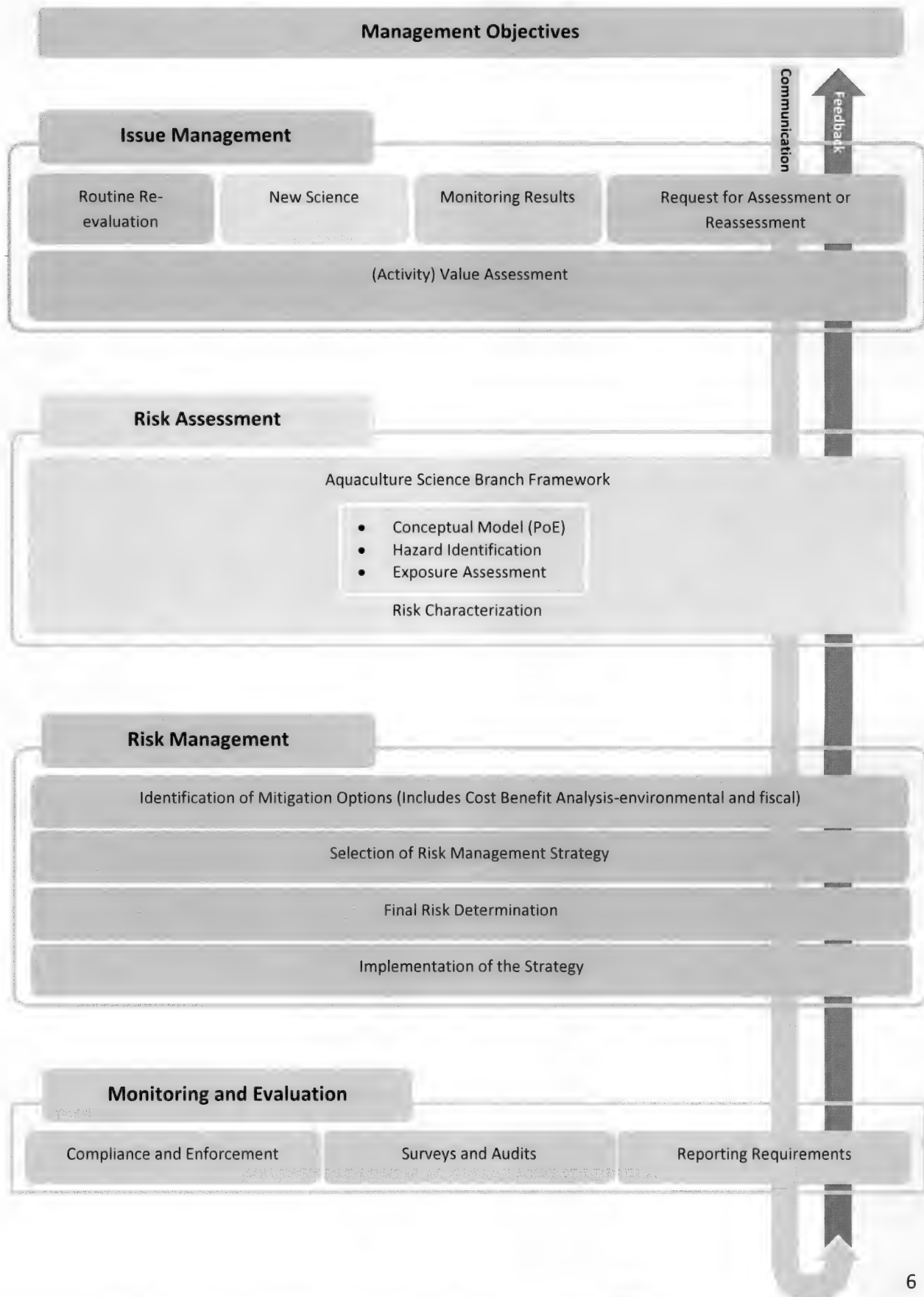
Throughout this process, communication and feedback are critical.

Integral to this process is that management decisions are based on many considerations, including, but not exclusively, scientific, social, economic and political. It is important to note that not all aquatic areas require equal levels of protection, as not all areas are equally ecologically or biologically significant or vulnerable.

³ A Fishery Decision-making Framework Incorporating the Precautionary Approach: <http://www.dfo-mpo.gc.ca/fm-gp/peches-fisheries/fish-ren-peche/sff-cpd/precaution-eng.htm>.

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Figure 1: Aquaculture Environmental Risk Management Framework



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Management decisions should also take it into consideration, as may be available, Indigenous Peoples traditional and ecological knowledge.

This approach supports management decision-making with respect to both (1) the setting of broad management (mitigation and monitoring) measures, such as siting criteria and general conditions on operations; and, (2) the consideration of individual applications (e.g., new or amended licences), focussing resources on risks that are unique to the proposed application.

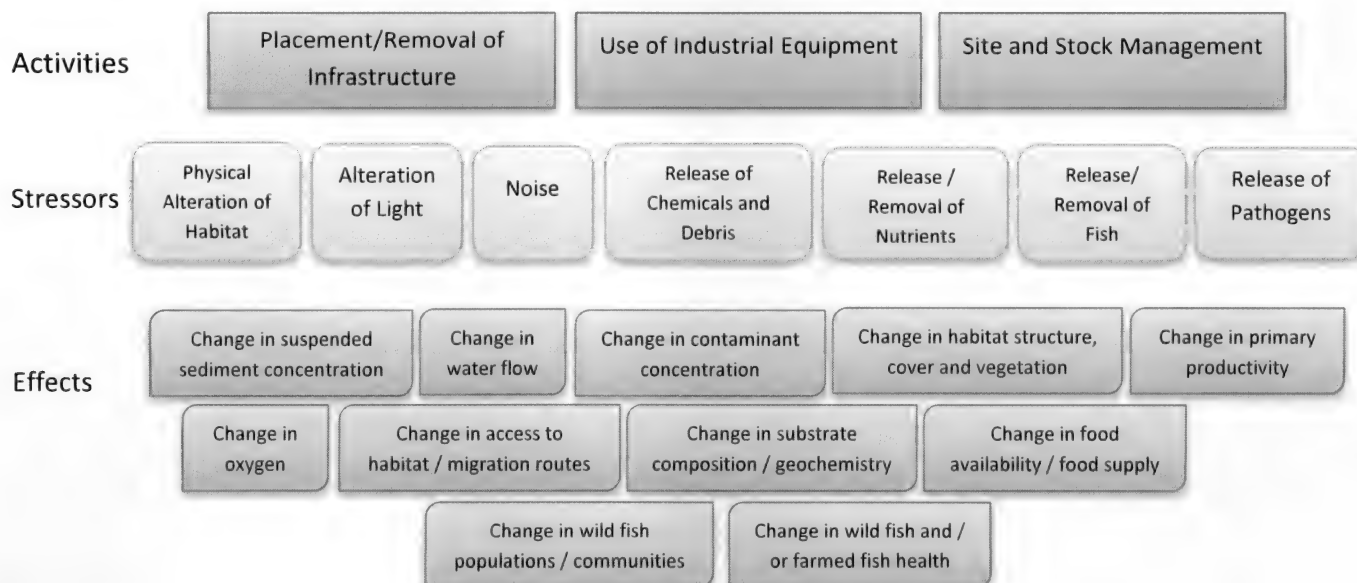
Pathways of Effects (PoE) Model

A Pathways of Effects (PoE) model is a tool that can convey complex interactions between human activities, the stress they can place on the environment (pressures), and environmental effects. The model operates on the premise that human activities can place stress on the environment which, in turn, can lead to various environmental effects. The model recognizes that a single environmental stressor can have multiple source activities and can lead to one or more environmental effects. It also recognizes that a single environmental effect can be influenced by one or more stressors or activities.

PoE diagrams group similar components together at each level in the model (activities, stressors and effects), noting inter-linkages in text descriptions of the environmental considerations. These diagrams and descriptions are designed to communicate information in a manner that facilitates the consideration of overall impacts on the environment, and the ecological benefits and costs of various potential management measures, including interactions between measures and cumulative impacts.

The scientific basis for links between aquaculture activities, stressors and effects was peer-reviewed through DFO's Canadian Science Advisory Secretariat process, and the summaries of the scientific state of knowledge for each of the stressors. This information is available for use in the evaluation of aquaculture activities and the identification of where management intervention may be required to protect fish and/or fish productivity/populations.

Figure 2: Pathways of Effects for Finfish and Shellfish Aquaculture



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At the specific aquaculture application level, the linkages between each of the stressors and the relevant effects are considered. The specific environment and activity will determine which stressor-effect linkages exist, and what mitigation measures can be used to effectively and sustainably break the stressor-effect linkages.

- **Physical alterations to the habitat** occurs when activities related to placing or removing physical infrastructure (e.g. net pens, longlines, rafts, anchors and moorings, shellfish beach culture structures), as well as during the use of husbandry equipment (e.g. underwater lights to increase growth in marine finfish or acoustic deterrent devices to discourage predators⁴).

The extent and impact of the predicted physical alterations to habitat are considered primarily during the pre-operational stage (e.g. site application), which includes an evaluation of the type of benthic habitat in the area being proposed for aquaculture.

- **Release of chemicals and debris** occurs primarily with activities associated with site and stock management, and the use of operational equipment where chemicals and debris may be released. Examples include the use of pesticides, drugs and antifouling agents, and the use of materials in construction (e.g. steel, wood, floatation) and operations (e.g. feed bags, ropes), which can be lost from sites as debris.

The effect of the use of pesticides, drugs and antifoulants on the receiving environment, including on non-target organisms, is assessed by Health Canada.

- **Release of organic and related matter** occurs as a result of stock management activities (e.g. the feeding and cultivation of fish, removal or natural sloughing of biofouling organisms from physical infrastructure) that have an organic or related component (e.g. nutrients).

The predicted extent of organic deposition on the surrounding seafloor is assessed at the pre-operational stage. As part of the on-going operational compliance, marine finfish aquaculture operations must meet a performance-based regulatory requirement related to the release of organic matter.

- **Removal of nutrients and organic matter** occurs as a result of stock management activities where some cultured species (e.g. bivalves) remove particulate matter, nutrients and oxygen from the water column.

The predicted extent of the removal of nutrients on wild populations is assessed at the pre-operational stage.

- **Release or removal of fish** occurs primarily as a result of stock management activities.

⁴ Note that the use of acoustic deterrent devices is not a current practice in Canadian aquaculture.

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The removal of fish is considered and managed as bycatch. This occurs when some individual wild fish may be temporarily or permanently removed from waters along with cultured fish (e.g. during grading or at harvest), or as part of biofouling or predator control.

The addition of fish to the environment occurs either as a result of intentional stocking of cultured fish into aquatic environments for cultivation (e.g. salmon enhancement), or as a result of unintentional release of fish (e.g. escapes).

The impact on wild populations from the unintentional release of cultured organisms is considered at the pre-operational stage, and is also linked to fiduciary responsibilities associated with the *Species at Risk Act*.

- **Release of pathogens and pests** occurs associated with site and stock management. The increase in biomass of fish within an aquaculture site can influence the presence or abundance of fish pathogens (e.g. bacteria, viruses) and pests (e.g. sea lice and tunicates).

The introduction of pathogens or pests is evaluated at the operational stage, primarily by the Introductions and Transfers Committees (ITC). Conditions of licence outline mitigation measures for the management of the abundance of pathogens or pests.

Additionally, notifiable diseases are regulated by the Canadian Food Inspection Agency.

Additional details on the characterization of each of the stressors, the current status of regulatory thresholds, and current management and mitigation practices are found in Annex 1. Also, a case study for the management of sea lice in B.C. is found in Annex 2.

Stakeholder and Indigenous Peoples' Engagement

Stakeholder and Indigenous peoples' engagement to support sound aquaculture governance is critical. The lack of social licence is a major barrier to robust aquaculture growth. Other factors, including the type of regulatory regime or site-specific development capacity characteristics, may play a role, but not to the extent of societal acceptance. The best mechanism for sustainable growth is via coastal zone and area-based management approaches which fully engage interested stakeholders and indigenous groups, who may actually contribute to decision-making. These processes not only support general agreement of where sites should go, but also the areas of greatest concern to focus on.

It should be recognized that some risks are new or emerging, and the evolution of scientific knowledge may influence society's tolerances and its chosen level of protection. An understanding of the "public's tolerance for risks" or "society's chosen level of protection" underpins the need for high transparency, clear accountability, and meaningful public involvement and communication.

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Two-way sharing of information and the inclusion of a range of perspectives in the decision-making process can become the cornerstone of openness and transparency, and enhance credibility of and trust in the decisions that the Government develops.

Conclusion

DFO has managed aquaculture over the years based on managing environmental impacts and the potential risks these can pose to fish habitat and fish populations, as identified through the DFO peer-reviewed science process. Where relevant, DFO regulators strive to develop management standards or thresholds, which are informed by science, based on best practices globally, and have received some form of stakeholder and indigenous peoples' input.

Aquaculture management is a shared responsibility between the federal and provincial governments; thus, management frameworks need to be foundationally the same. In circumstances where there is a potential for unacceptable harm to fish (population-level effects), it may be appropriate to make decisions and implement precautionary measures in the near term, without having full certainty of the probability or magnitude of harm. Close monitoring would also occur to assess the effectiveness of the measures in addressing risk and overall impacts. Follow-up activities, including research and monitoring, are key to reducing scientific uncertainty and allow improved decisions to be made in the future. Finally, stakeholder and Indigenous peoples' engagement throughout the risk management process is critical, not just at the final decision-making process.

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Annex 1: Details on Aquaculture Stressors, Effects and Risk Management

STRESSOR	THRESHOLD	MANAGEMENT ACTION / MITIGATION
<p>Release of pests and pathogens</p> <p>Pathogens can be endemic in wild fish populations (i.e., occur naturally in wild populations in a region) or exotic (i.e. occur naturally in other locations and have been introduced in a region). The presence of endemic pathogens can be amplified under some circumstances where fish are in close proximity (e.g. spawning grounds, schooling and aquaculture) Endemic pathogens tend to have a less severe effect on native populations than exotic (or introduced, non-endemic) pathogens, as over multiple generations native species have typically developed an immune response to endemic pathogens</p> <p>The health status of wild fish often cannot be directly assessed, and changes in wild fish populations or communities due to disease are difficult to determine. Diseased and moribund fish are quickly removed from the population through processes such as predation or mortality; sampling can therefore be easily biased toward healthy individuals. The presence or absence of pathogens is particularly difficult to determine in wild fish populations, nor is there available scientific data to determine the effect of low level presence of pathogens at the individual or population level.</p>	<ul style="list-style-type: none"> Sea lice threshold (B.C. only), Mandatory Reporting of Fish Health Events (i.e., treatment or % loss) (B.C. only) 	<p>Conditions of licence require treatment for sea lice above threshold (3 lice/fish in B.C.)</p> <p>Monitoring fish health is a particularly important mitigation tool when cultured fish are destined for movement to another location or for release into aquatic environments. The determination of the appropriateness of planned movements or releases of fish must be based upon a review of the disease and mortality history of the cohort, on recommendations by a qualified fish health professional, on the results of any recommended pre-release disease screening, and on guidance from regulatory agencies.</p>
<p>Release (or removal) of organic matter and nutrients</p> <p>Potential sources of the release of other organic matter include fish carcasses (e.g. from cultured fish or bycatch⁵), feed spillage, faeces,</p>	<ul style="list-style-type: none"> BOD threshold 	<p>Footprint addressed through initial siting decisions (benthic impact depositional modeling)</p> <p>Performance based threshold (on-going assessment once/production cycle) – under the AAR, sites cannot be restocked</p>

⁵ The release of incidental finfish catch during finfish harvest, as may be required under conditions of licence, may contribute to organic matter in the environment if the fish are dead or have a low chance of survival.

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<p>harvest waste or offal, including blood. Release of organic matter into the marine environment from humans working and/or living on site could also constitute a minor contribution of organic matter to aquatic environments, should it occur. Human waste is generated on boats or in working or living accommodations as part of daily activities like cooking, bathing and bodily functions. The majority of organic matter introduced into the environment from finfish aquaculture will be associated with excess feed and faeces. Accumulation of the organic matter can result in a change in the benthic biodiversity around a site.</p>		<p>if sulphide threshold exceeded</p>
<p>Release of chemicals/drugs</p> <p>Pesticides are assessed by the Pest Management Regulatory Agency of Health Canada for value of use, human, animal and environmental risks under the <i>Pest Control Products Act</i>. Factors considered in environmental risk assessments related to pesticides include the potential transport and dispersal of products and/or their constituents following release into waters, as well as the exposure of non-target organisms to concentrations of substances that could result in lethal or sub-lethal (e.g. behavioural, reproductive) effects. The severity of impacts on exposed non-target species will depend on factors such as the toxicity of the product used, the dosage, the presence of susceptible non-target species / life stages of species, and environmental conditions.</p>	<ul style="list-style-type: none"> No thresholds – Research and analysis underway to provide advice on the design of a post-deposit monitoring program. 	<p>PRMA can place limits on the timing, location and volume of the release of specific materials.</p> <p>Under development – traffic light system for 1) pre-siting assessment to inform site placement, and 2) cumulative impacts [informed by post deposit monitoring program (site level) and aquaculture monitoring program (bay scale)]</p>
<p>Physical alteration of habitat</p> <p>The addition, removal, and</p>	<ul style="list-style-type: none"> Maximum shellfish aquaculture coverage of 7% per bay in some areas of Canada 	<p>Primarily addressed through initial siting considerations.</p> <p>In situations where wild fish may be</p>

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<p>modification of physical structures may affect bottom sediments, benthic communities, pelagic communities, and hydrodynamics.</p>		<p>present only on a seasonal basis, or where habitat is used by a species during a particular period (e.g. during reproductive phases), measures to limit the duration, timing or extent of installation, harvest or site maintenance activities may be warranted.</p>
<p>Release (or removal) of fish</p> <p>Farmed finfish, including salmon, may escape, usually due to equipment failure or human error. Equipment failure may be weather-related, caused by predator attacks or other events that stress the containment infrastructure. For there to be genetic intrusion, establishment of non-native populations, predation or competition, farmed fish must first be released into the wild through escape or the release of viable gametes.</p>	<ul style="list-style-type: none"> • Reporting of escapes may be required, depending on jurisdiction • No <i>direct</i> genetic impact risk on West Coast from Atlantic salmon farms 	<p>Addressed through conditions of licence and development of national containment standards (to be developed)</p> <p>Regulation of fish containment structures and use of triploid farmed fish would further lower the extent of direct genetic interaction.</p> <p>In the event that an unintentional release does occur, measures such as escape response plans may help to recover released fish., particularly where a significant risk of harmful interaction with wild populations has been identified.</p> <p>Escape reporting and analysis of the measures employed may be used to help assess the effectiveness of current mitigation measures and develop future facility or regulatory measures, as appropriate. Measures for recording and reporting cultured fish inventories as well as accurate records of introductions and transfers of licensed species support a broader understanding of the scope (estimated quantity, species and timing) of unintentional releases, and may form part of the management approach in mitigating their effects.</p> <p>In circumstances where a new species is being considered for rearing in an area for the first time, a specific environmental risk assessment is warranted to determine whether or not an Introductions and Transfers licence should be issued (see National Code on Introductions and Transfers LINK). The Code provides guidance that the I&T risk assessment should typically focus on incremental risk aspects that are particular to that species. Species identified as higher risk may have special regulatory conditions imposed on</p>

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		<p>them to bring the risk to an acceptable level. Where risk outcome warrants, some species may not be authorized for culture. An I&T risk assessment may also be warranted where a species is native to the province but new to culture. In terms of risks related to release of fish, the assessment should start by focussing on the probability of the cultured gametes interacting with wild fish populations, and in the case of finfish, the potential for escaped fish to interact and compete with populations of the same or other species.</p>
<p>Noise</p> <p>Noise associated with aquaculture operations may be produced incidentally during the routine operation of equipment such as aerators, feeders, generators and power washers, and by vessels servicing aquaculture facilities. The effects of such noise are expected to be localized, short-term and likely insufficient to cause injury or permanent displacement to marine organisms.</p>	None	<p>Addressed through initial siting considerations and conditions of licence</p>
<p>Alteration in light</p> <p>Measurements of light penetration around net pens show that little visible light is found outside the pens, which suggests that the use of lights in aquaculture will have minimal and mainly local ecological effects.</p>	None	<p>Addressed through initial siting considerations and conditions of licence</p> <p><i>In B.C. is there still a requirement to report the use of lights?</i></p>

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Annex 2: A Case Study- Management of Sea Lice in B.C.

1. Description of Stressor and Potential Impact – Sea Lice

Environmental

The release of pathogens or viruses from aquaculture facilities through site and stock management is a stressor described in the Canadian Science Advisory Secretariat (CSAS) research document “Pathways of Effects for Finfish and Shellfish Aquaculture” (PoE). The primary effect associated with this stressor, as described in the PoE, is a change in wild fish and/or farmed fish health. Additional sea lice specific science advice has also been provided, and this case study and analysis draws on this advice⁶.

Sea lice are endemic to the Pacific Coast and are found on several species of Pacific salmon and non-salmonid species. They are also present in other areas of the world where Atlantic salmon reside, such as Norway and Scotland. There are a number of sea lice species throughout the world that have a range of hosts and life cycle characteristics. The species of concern in B.C. from an aquaculture perspective is the *Lepeophtheirus salmonis* (Salmon louse); however, there is another species, *Caligus clemensi* (Herring louse) which can occasionally cause concern in aquaculture facilities. The sea lice life cycle includes numerous stages, such as: the free-floating Nauplius stage, infectious copepodid stage, attached chalimus stages, and finally the motile stages (pre-adults, adults).

Farmed Atlantic and Pacific salmon are stocked at the marine sites free of lice and infection occurs by exposure to passing adult wild salmon. This is known as “spillover.” The intensity of infestation on farmed salmon is based on a number of factors including the size of the wild salmon run, sea water temperature, salinity and the health of the farmed fish. Cultured Pacific salmon are less susceptible to sea lice infestation than Atlantic salmon. When infestation occurs at a farm the sea lice numbers may become internally amplified, which may result in “spillback” to wild salmon. Of particular concern is the effect this may have on juvenile salmon smolts which have recently entered the marine environment as they are most susceptible to sea lice. Wild salmon smolts out-migrate from their natal streams during the spring and early summer. A corresponding “out-migration window” with different requirements for management of lice levels is incorporated into the licence conditions. The out-migration window as currently defined runs from March 1st until June 30th annually.

Social

There is a high level of concern from a segment of the public, some First Nations and ENGOs, on

⁶ Assessment of Sea Lice Monitoring and Non-Chemical Measures, DFO 2014 [SAR 2014/006](#)

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the impact aquaculture has on wild Pacific salmon, and more specifically belief that sea lice can significantly negatively impact wild salmon populations. Wild salmon populations can be highly variable and in some cases a low run in one year can be followed by record high numbers; this happens in areas both with and without aquaculture facilities on migratory routes. Conflicting opinion about the possible impact of high levels of sea lice has not given these groups, governments, the media or the Canadian public a level of comfort that the Department is properly managing the risk the aquaculture industry may pose to wild salmon.

2. Current Management and Mitigation – Sea Lice

The goal of the current management approach is to ensure that no disease or disease agent negatively impacts the protection and conservation of fish. Presently, risk related to sea lice is managed through licence conditions and the Fish Health auditing program.

Pre-Operational Management Approach

The Precautionary Approach is applied during the consideration of new sites, both from a site-specific and broader area perspective. This is also true for applications for increased production at an existing site. There is recognition of the potential risk of increased sea lice abundance and corresponding infection of out-migrating salmon from licenced facilities as a result of increased production. Assessments including the history of sea lice abundance levels at that farm and neighbouring farms in the general area include recommendations for mitigation measures, such as area-based management (e.g. coordinated and timing of stocking, fallowing and sea lice treatments), maintenance of single-year classes, practicing integrated pest management, and timing of stocking to reduce the need for sea lice treatments. Geographic elements considered during the assessment include hydro-connectivity between the proposed site and adjacent farms, and proximity to known salmon migration routes.

When siting new facilities, efforts are made to avoid the siting of new aquaculture facilities in areas which are known to be important wild fish migration routes, nurseries, sensitive habitats, or have other importance to wild fish populations or significant to First Nations. Ongoing science and research forms part of this consideration.

Current Operational Management Approach

The licence conditions include sea lice monitoring protocols as well as sea lice abundance thresholds that a licence holder cultivating Atlantic salmon must abide by. This threshold is set at an average of three motile (pre-adult and adult) lice (*Lepeophtheirus salmonis*) per fish. During the outmigration period, salmon farmers are required to maintain lice levels below the three motile lice threshold. Outside this period, they are not obligated to maintain this threshold, but must notify DFO when they exceed and develop a mitigation strategy for consideration by DFO officials. This system allows for lice control during the sensitive out-

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migration period, but does not require treatment outside this period, thereby reducing the use and potential development of resistance to various sea lice therapeutants. Sea lice sampling on farms is required every two weeks at minimum during the out-migration period, and DFO auditing of the reported numbers and sampling methodology occurs on 50% of all active farms during this time. For the remainder of the year, sampling by industry is only required once per month, but will increase to every two weeks if threshold levels are exceeded.

Mitigation

Companies are increasingly moving towards an area-based management approach where all smolts in a given area are the same year-class and, if treatments are required, they are coordinated between these sites. Treatments are ideally timed in coordination with returning adult wild fish so that all wild fish have left the area before treatment is initiated. This is to avoid reinfection and retreatment which can lead to resistance. Currently the primary sea lice treatment is the use of emamectin benzoate (SLICE), which is an in-feed parasiticide.

In some areas in B.C., SLICE resistance has emerged in recent years. Industry is rapidly developing alternative treatment modalities to curtail SLICE resistance, and prevent the development of wide-spread resistance in the sea lice population in B.C. This involves the rotational use of alternative treatment methods, such as novel in-feed parasiticides, hydrogen peroxide baths and/or mechanical sea lice removal (e.g. Hydrolicer). An alternate method of reducing absolute sea lice inventory is through harvesting, which typically would occur when fish are near harvest weight. This method is only effective if harvesting is done at a rate that reduces a farm's absolute sea lice inventory (as defined in the licence).

3. Scientific Certainty – Sea Lice

A large number of scientific studies have been conducted in recent years which have tried to determine what, if any, harm is posed to wild salmon by sea lice spillback from Atlantic salmon farms. No conclusive evidence has been found to suggest that sea lice originating from farms are causing harm to wild stocks on a wide scale. This has largely been accepted by stakeholders and opponents to the salmon farming industry. This indicates that the three motile threshold is sufficiently conservative to mitigate risk to wild salmon posed by sea lice originating from farms. In the rare instances where farms have not been able to control lice levels during the out-migration period (often as a result of SLICE resistance), lice levels are found to be higher on out-migrating salmon smolts. This indicates that lice management on farms is vitally important to prevent an undue lice burden on wild smolts.

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4. Residual Risk and Application of the Precautionary Approach – Sea Lice

Environmental

A changing climate makes future lice mitigation more uncertain and challenging. In years with warmer water temperatures and increased salinity the management of lice becomes more difficult. This is likely to become more common as time progresses. Additionally, the emergence of SLICE resistance on B.C.'s coast has presented a significant challenge to industry for effective lice management. The adoption of additional treatment options by industry is very welcome and has demonstrated that lice levels should be able to be effectively controlled, despite a changing climate and without sole reliance on SLICE. Effective management is vital to ensure that wide-spread resistance to lice therapeutants does not occur as it has in other jurisdictions. Ongoing research into the genetic determinants of lice resistance, use of cleaner fish, alternative treatments and alternative cage designs/husbandry methods are all very promising, and should be encouraged and supported to allow proactive management by industry. Under the present management regime, the residual risk once operational is determined to be medium. Application of the Precautionary Approach requires that the Department utilize existing and potential new management measures to ensure that the risk stays within an acceptable range.

Context	Risk Attributes			
		High	Moderate	Low
	High			
	Moderate		X	
	Low			

Social

Based on the level of scientific certainty that sea lice are not causing harm to wild fish populations the level of concern raised by the public is expected to diminish over time. Due to the variable nature of salmon returns there may continue to be a perception that declines in salmon populations are related to sea lice impacts. As noted above, environmental residual risk exists based on changing climate conditions. It is incumbent on DFO to ensure a robust scientific program remains in place to better understand how the change in climate conditions is affecting sea lice, and their interaction with farmed and wild fish. If this scientific research along with changing management requirements (as necessary) is communicated to the public in a pro-active manner, social acceptance should increase.

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	Risk Attributes			
Context		High	Moderate	Low
	High			
	Moderate		X	
	Low			

5. Next Steps and Future Developments – Sea Lice

DFO conditions of licence relating to lice have been found to be vague, outdated and sometimes unenforceable. Some preliminary ideas on changes to the licence to allow better regulation, while also providing additional tools and guidance to industry, include:

- Consider moving to adult female-based threshold, rather than current motile threshold.
- Establishment of a farm-based, in addition to a fish-based (as currently used), sea lice threshold (For example, we assume 500 000 fish on farm, with three motiles = 1.5 million lice allowable on a single farm).
- Harvest would no longer be deemed an appropriate management action within the out-migration [would only be used to lower farm-based “absolute sea lice inventory” below farm-level threshold (as mentioned above) before entry into out-migration].
- Change licence condition of “active farm” away from number of pens stocked (more than 3), to absolute number of fish on site for a given time (e.g. active site could be defined as: more than 30 days have passed since the introduction of more than 50 000 fish to a sea site).
- Consideration be given to initiating mandatory sea lice reduction prior to March 1, which is the generic time when out-migration is recognized to start, as stated in licence conditions.
- Implement mandatory post in-feed lice treatment reporting to better monitor efficacy.
 - E.g. 25-30 days have passed since the completion of treatment with an in-feed parasiticide medication.
- Implement prohibition on use of lice chemical therapeutant for a time in response to resistance.
 - E.g. treatment failure could be defined as: “failure to achieve > 60% reduction in pre-treatment lice numbers at the 25-30 day post-treatment counts”.
- SLICE use would be prohibited at that site again during the calendar year.

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Moving forward the Department must continue to do scientific research on sea lice and its relationship to farmed and wild salmonids in order to develop a clearer understanding of the possible linkages between the two and the corresponding risk to cultured and wild fish. It should also be cognizant of, review related independent science (science which comes from sources outside of DFO), and react to key new findings by adjusting our research objectives. Operationally DFO must adapt to new science, making changes to present management approaches as necessary.

Although the risk posed by sea lice is considered low based on our present scientific understanding, a Precautionary Approach to the siting of new farms in the future could incorporate the potential of sea lice becoming a higher risk because of changing environmental conditions.

Over and above the current operational management approach it is recommended that a risk-based traffic light system be implemented that would be tied to some objective measure of sea lice abundance (e.g. number and severity of exceedances). This approach could amalgamate information from an individual farm or a number in a geographic area that have hydro-connectivity. It is well established that sites which have good overall fish health performance, including a low sea lice burden, are less likely to become susceptible to disease.

A green designation would indicate that historically a site has good sea lice management with rare incidences of threshold exceedance and low or negligible mortality indicating a low residual risk to wild salmon. The Department could consider increases in production at these sites. A yellow designation would indicate some recurrent sea lice threshold exceedances that are able to be managed on site without the risk of associated fish health issues and do not represent a notable threat to wild salmon. Increases in production would not be considered and additional management measures may be required. A red designation would indicate serious, significant or repeated sea lice exceedances that could potentially represent a notable threat to wild salmon. Drastic management measures could include reducing authorized production, a requirement to fallow for a significant time period, or cancellation of the licence.

At present there is a lack of flexibility in the licence conditions to require actions such as those outlined for farms designated red as the Department does not have the legislative authority. Moving forward the Department should pursue legislative/regulatory changes to obtain this authority.

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APPENDIX I: Marine Finfish Pre-Operational Risk Table

There are a number of elements that are already assessed at the pre-operational application stage and the risks are summarized for senior management in a table.

Farm name:	Company:			
Elements Assessed – Wild Fish and Fish Habitat	Low	Med	High	N/A
Presence/use and interactions with CRA fishery or rare species				
Presence of important fish habitat (e.g. sponge reefs, rockfish nursery, etc.)				
Presence/use and interactions with SARA listed species				
Appropriate distance to salmonid-bearing streams				
Appropriate distance to important herring spawn areas				
Appropriate distance to shellfish beds				
Appropriate depth, currents and benthic substrate				
DEPOMOD predictions acceptable				
Existing seabed conditions (e.g. capable of assimilating waste)				
Historic benthic monitoring results				
Use of lights				
Marine mammal usage & mitigation				
Elements Assessed – Fish Health	Low	Med	High	N/A
Diseases of concern on farm, nearby farms, and in area (if known)				
History of appropriate disease management on farm and nearby farms				
Prudent history of medicant use (if known)				
Hydrological connectivity with other farms & co-management plan(s)				
History of compliance and reporting on FH and SL				
Adequacy of submitted FHM, SOPs and Carcass Management Plans				
Water quality (e.g. DO, water flow; if known) & mitigation				
Natural challenges (e.g. plankton issues, harmful algal blooms; if known) & mitigation				
Fish density appropriate to maintain good FH (if known)				
Species intended to be grown is appropriate for the area				
History of predator stress & mitigation (if known)				
Elements Assessed – Sea Lice	Low	Med	High	N/A
Natural occurrence of sea lice at site				
History of staying below sea lice thresholds during smolt out-migration				
Appropriate use of available tools to manage sea lice in future				
Elements Assessed – Existing Fisheries	Low	Med	High	N/A
CSSP closure on bivalve shellfish beds used in CRA fisheries				
First Nations FSC fisheries/site access				
Commercial fisheries (direct or indirect displacement – reduction in stock				
Recreational fisheries (direct or indirect displacement – reduction in stock				
EFA/test fishery/research area				
Geoduck beds				

Jones, Simon

From: Jones, Simon
Sent: Wednesday, September 26, 2018 11:45 AM
To: Higgins, Mark; Garver, Kyle
Subject: RE: Aquaculture Risk Management Framework and the Application of the Precautionary Approach
Attachments: Application of the Precautionary Approach Within a Risk Management Framework.._sj.docx
Categories: Yellow Category

Mark,
Here are my thoughts and comments.
Simon

From: Higgins, Mark
Sent: September-24-18 4:18 PM
To: Garver, Kyle; Jones, Simon
Subject: FW: Aquaculture Risk Management Framework and the Application of the Precautionary Approach
Importance: High

I would like the 2 of you to be part of this review please. Can you provide comments on the attached document and return to me by next Monday? Thanks,

From: Lowe, Carmel
Sent: September-19-18 12:05 PM
To: Higgins, Mark; Holmes, John; Kennedy, Eddy
Cc: MacDougall, Lesley; Houston, Kim; Patten, Bruce
Subject: FW: Aquaculture Risk Management Framework and the Application of the Precautionary Approach
Importance: High

All – see below and attached.

Mark – I would like you engage the others on this email and provide me with a list of the staff that should be included in a review of this draft approach. I propose we then convene a meeting of those staff and those on this email to conduct the review and provide a consolidated response back to Jay and Ingrid. Let me know if there are any issues/concerns with this proposed approach – and if so, what are alternate suggestions completing the review.

I will ask Catherine to find a time for this regional review meeting during first week of October. I am guessing we will require 2 hours.

Carmel

Carmel Lowe, Ph.D.
Regional Director Science | Directrice régionale des sciences
Fisheries and Oceans Canada | Pêches et Océans Canada
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Government of Canada | Gouvernement du Canada

From: Parsons, Jay

Sent: September 19, 2018 11:48 AM

To: McCallum, Barry <Barry.McCallum@dfo-mpo.gc.ca>; Vézina, Alain <Alain.Vezina@dfo-mpo.gc.ca>; Bliss, Doug <Doug.Bliss@dfo-mpo.gc.ca>; de Lafontaine, Yves <Yves.deLafontaine@dfo-mpo.gc.ca>; Wang, Sen <Sen.Wang@dfo-mpo.gc.ca>; Lowe, Carmel <Carmel.Lowe@dfo-mpo.gc.ca>; Laverdure, Louise <Louise.Laverdure@dfo-mpo.gc.ca>

Cc: McPherson, Arran <Arran.McPherson@dfo-mpo.gc.ca>; Moore, Wayne <Wayne.Moore@dfo-mpo.gc.ca>; Burgetz, Ingrid <Ingrid.Burgetz@dfo-mpo.gc.ca>; Davis, Ben <Ben.Davis@dfo-mpo.gc.ca>; Meade, James <James.Meade@dfo-mpo.gc.ca>; Sullivan, Mike DJ <Mike.Sullivan@dfo-mpo.gc.ca>; Blair, Tammy <Tammy.Blair@dfo-mpo.gc.ca>; Cooper, Lara <Lara.Cooper@dfo-mpo.gc.ca>; Paul, Stacey D <Stacey.Paul@dfo-mpo.gc.ca>; MacKinnon, Anne-Margaret <Anne-Margaret.MacKinnon@dfo-mpo.gc.ca>; Ouellette, Marc <Marc.Ouellette@dfo-mpo.gc.ca>; Pomerleau, Corinne <Corinne.Pomerleau@dfo-mpo.gc.ca>; Mckindsey, Chris <Chris.Mckindsey@dfo-mpo.gc.ca>; Christie, Gavin C <Gavin.Christie@dfo-mpo.gc.ca>; Geiling, Doug <Doug.Geiling@dfo-mpo.gc.ca>; Kennedy, Eddy <Eddy.Kennedy@dfo-mpo.gc.ca>; Higgins, Mark <Mark.Higgins@dfo-mpo.gc.ca>; White, Andrea <Andrea.White@dfo-mpo.gc.ca>; Pilcher, Scott <Scott.Pilcher@dfo-mpo.gc.ca>

Subject: Aquaculture Risk Management Framework and the Application of the Precautionary Approach

Importance: High

Le français suit

Colleagues,

As mentioned Monday, a draft Aquaculture Risk Management Framework/Application of the Precautionary Approach has recently been developed, in response to the Minister's request that the Department explain how aquaculture is managed and how the precautionary approach is applied. This supports a number of high profile and public expectations, including the Cohen Commission report, the Minister's mandate letter and the Spring 2018 report from the Commissioner for the Environment and Sustainable Development.

It is important to note that this document is very much still a work in progress. For example, the intention is to balance this document nationally by including additional examples in Annex 2 incorporating east coast applications.

Prior to engaging with the Provinces, Territories and Indigenous Peoples, comments and feedback internally is being sought. Aquaculture Management sent out a version Tuesday to their RDs seeking their comments on the applicability of the framework to aquaculture, and changes and/or improvements.

The attached version is the most recent and current version and should be used for the purpose of review. Unfortunately, it is currently only available in English; the translated version will be sent when it becomes available.

Aquaculture Management has requested feedback by **Friday October 12, 2018**. Therefore, the comments from EOS will also need to be submitted by that time as well.

We ask that you broadly engage the DFO Science community within your region (i.e., in addition to aquaculture staff, also fisheries science and habitat science staff, etc.).

Please send your collated comments, corrections and suggestions to Ingrid Burgetz and Jay Parsons, with a cc to Wayne Moore by October 12th. Ingrid and Ed Porter from Aquaculture Management will then integrate all the comments into the next version. As well, we have been asked to convene a departmental technical review meeting of the document

with internal (Science and Management) and external experts. We will soon be approaching you for suggested regional participants (Aquaculture / Fisheries / Habitat Science). This will also be an additional or alternate approach to providing regional input into the document.

Next steps following this include:

- DFO finalization of the document for external consultation, including presentation to the Minister
- DFO Science & Management internal and external technical review (details to be shared shortly)
- Consultations with P/T through the Canadian Council of Fisheries and Aquaculture Ministers
- Industry consultation
- Indigenous consultations
- Public consultation (on DFO website)
- Final posting on DFO's website

Thank you very much to your collaboration and support.

I apologize for the tight timelines, but this file has the express interest of the Minister.

Chers collègues,

Comme mentionné lundi, une ébauche du cadre de gestion des risques liés à l'aquaculture et de l'application de l'approche de précaution a récemment été élaborée en réponse à la demande du ministre voulant que le Ministère explique la façon dont l'aquaculture est gérée et dont l'approche de précaution est appliquée. Cela appuie un certain nombre d'attentes publiques de premier plan, y compris le rapport de la Commission Cohen, la lettre de mandat du ministre ainsi que le rapport publié par la commissaire à l'environnement et au développement durable au printemps 2018.

Il est important de mentionner que ce document est loin d'être définitif. Par exemple, pour que ce document soit équilibré à l'échelle nationale, nous souhaitons inclure à l'annexe 2 d'autres exemples d'application sur la côte est.

Avant de collaborer avec les provinces, les territoires et les peuples autochtones, nous désirons d'abord obtenir des commentaires à l'interne. Mardi, l'équipe de la Gestion de l'aquaculture a envoyé une version du document à ses directeurs régionaux afin d'obtenir leurs commentaires sur l'applicabilité du cadre à l'aquaculture, ainsi que des suggestions de modifications ou d'améliorations, le cas échéant.

Vous trouverez ci-joint la version la plus récente sur laquelle vous devez vous baser pour effectuer votre examen. Malheureusement, elle n'est disponible qu'en anglais pour le moment; vous recevrez la version traduite dès qu'elle sera prête.

L'équipe de la Gestion de l'aquaculture a demandé que les commentaires soient fournis d'ici le vendredi 12 octobre 2018. Les commentaires des Sciences des écosystèmes et des océans doivent donc aussi être soumis d'ici cette date.

Nous vous demandons de mobiliser, en plus de votre personnel d'aquaculture, la communauté scientifique de Pêches et Océans Canada (MPO) de votre région (le personnel scientifique des pêches et de l'habitat, etc.).

Veuillez envoyer vos commentaires, vos corrections et vos suggestions à Ingrid Burgetz et Jay Parsons, avec copie conforme à Wayne Moore, d'ici le 12 octobre. Ingrid et Ed Porter de l'équipe de la Gestion de l'aquaculture intégreront par la suite tous les commentaires reçus dans la prochaine version. De plus, on nous a demandé de convoquer une réunion d'examen technique du document avec des experts internes (scientifiques et gestionnaires) et externes. Nous

vous contacterons bientôt pour des participants régionaux (Science de l'aquaculture des pêches ou de l'habitat). Ce sera également une approche supplémentaire ou alternative pour fournir une contribution régionale au document.

Par la suite, les prochaines étapes seront les suivantes :

- Le MPO finalisera le document aux fins de consultation externe et de présentation au ministre.
- Les équipes des sciences et de la direction du MPO effectueront un examen technique interne et externe du document (les détails seront fournis sous peu).
- Des consultations seront menées auprès des provinces et territoires par l'intermédiaire du Conseil canadien des ministres des pêches et de l'aquaculture.
- L'industrie sera consultée.
- Les peuples autochtones seront consultés.
- Le grand public sera consulté (par l'entremise du site Web du MPO).
- La version définitive du document sera affichée sur le site Web du MPO.

Je vous remercie grandement pour votre collaboration et votre soutien.

Je tiens à m'excuser pour les délais serrés, mais ce dossier est d'un grand intérêt pour le ministre.

Jay

On behalf of SRS and EOSS

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Application of the Precautionary Approach within a Risk Management Framework for Aquaculture

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Introduction

Globally, aquaculture continues to grow faster than other major food production sector, and has been identified by the FAO, as a critical contributor to food, nutrition and employment in the global economy.¹ The Government of Canada recognizes aquaculture's significant benefits to society, including providing full-time jobs in coastal Canada. In Canada, aquaculture is a relatively new industry and is jointly managed by the federal and provincial governments. There is tremendous potential for the Canadian industry to become an even greater player in overall world production. However, societal conflicts over which human activities are acceptable in Canadian waterbodies have created challenges to the growth and sustainability of aquaculture in Canada. This is often expressed as environmental sustainability concerns, ranging from direct environmental impacts to indirect impacts on wild fish health and productivity. A well-defined risk management framework, which embodies a clear understanding of unacceptable harm, taking precautionary steps where relevant and fully engaging the public throughout the entire risk-management process can help to clearly communicate where there are environmental risks, and can address both environmental sustainability issues and public concerns.

Fisheries and Oceans Canada's (DFO) mandate relates to the conservation of fish and fish habitat. This applies equally to fisheries as it does to decisions related to aquaculture. The starting point for any decisions made by DFO regarding human activities around waterbodies in Canada, including aquaculture, is founded on three key pieces of federal legislation: the *Fisheries Act*, the *Oceans Act* and the *Species at Risk Act*. Consequently, in executing the Department's fiduciary duty, the conservation of fish and fish habitat requires the conservation of biodiversity within the ecosystem, and the habitat and productivity of fish species. Given the complexity of detecting or monitoring biodiversity or productivity, proxies are used as practical measures for managing the environment. Therefore, the threshold for unacceptable harm to fish or fish habitat is any activity that has the potential to cause a population-level effect to fish species.

In addition, there are international commitments and best practices that are relevant to the management of activities. The Rio Declaration of the UN Conference on Environment and Development (UNCED) supports the right of sovereign states to pursue responsible economic development opportunities as long as other member states or future generations are not negatively impacted by such developments. The notion of the Precautionary Approach (PA) is geared towards large-scale threats, especially when the consequences are serious or irreversible (e.g., climate change).

Many governments apply the precautionary principle as part of an overall risk management framework to activities that may not potentially result in large-scale or permanent environmental impacts, but may be activities that have societal concern. It is within this context, that DFO applies precaution as required in delivering its regulatory and legislative responsibilities for aquaculture.

¹ FAO - The State of World Fisheries and Aquaculture 2018

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The following risk management framework for aquaculture is consistent with the overarching ~~Sustainable Fisheries Framework~~. It also builds on the 2008 ~~Aquaculture Policy Framework~~ (APF) and specific policies developed to support DFO's B.C. Aquaculture Regulatory Program (BCARP).

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Moreover, this Framework is not meant to create any new legal obligations to apply precaution. DFO's role in regulating the aquaculture sector is fundamentally linked to and is consistent with the overarching Sustainable Fisheries Framework. (SFF). The SFF provides the foundation for an ecosystem-based and precautionary approach to fisheries management in Canada, and provides the basis for ensuring Canadian fisheries are conducted in a manner which support conservation and sustainable use. Ultimately, through integration with the broader SFF, the residual effects of aquaculture on fish and fish habitat, following all mitigative actions, ensures that these effects can be taken into account in the sustainable management of fisheries.

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DFO'S Approach to Aquaculture Management

Aquaculture Management Objectives

The overarching departmental aquaculture management objective is to create the conditions for a successful and sustainable aquaculture industry across Canada. Within the overall objective, the department's goal for aquaculture is to ensure that fish and their habitats are protected using regulatory mitigation, monitoring and compliance approaches that are efficient, effective and aligned with the potential risk to the environment, and integrated (to the extent possible) with broader fisheries management approaches. Specifically, the **threshold for unacceptable harm to fish or fish habitat is any activity that has the potential to cause a population-level effect to fish species**. Recognizing that aquaculture is managed federally and by provincial and territorial governments, the department's overall assessment of risk will consider risk management and mitigation measures by all regulatory partners.

An Ecosystem and Precautionary Approach

Ecosystem approaches recognize that humans are part of, and have significant influences on, their environments. In aquaculture management under an ecosystem approach—as in fisheries management more broadly—regulatory decisions consider the impact of human activities on fish species, habitats, and the ecosystem of which these species are a part, and take into account broad ecosystem changes related to weather and climate. While it is recognized that all habitats, species, populations and communities play a role in aquatic ecosystems, some are more important from an ecological perspective and some are more resilient than others.²

DFO incorporates a precautionary approach within its ecosystem approach to fisheries management decision-making, supporting the economic use of resources while ensuring that

² *Principles of Ecosystem Based Fisheries Management*: <http://www.dfo-mpo.gc.ca/fm-gp/peches-fisheries/fish-ren-peche/sff-cpd/ecosys-back-fiche-eng.htm>.

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potential risks to aquatic environments are managed to prevent harm to fish populations and habitat, and to limit other less serious harm to the extent feasible given available technology and costs. Management decisions are more cautious when scientific information is uncertain, unreliable or less complete.³

Implementing an Ecosystem Approach in Aquaculture

An efficiently and effectively applied ecosystem approach for managing aquaculture in Canada includes risk management that considers environmental impacts holistically to enable the evaluation of ecosystem level impacts. This integrated strategy is supported through a risk management framework. The holistic evaluation of impacts is supported by the use of the Pathways of Effects (PoE) model for aquaculture (see next section).

Taken as a whole, this approach is designed to support the consistent regulatory management of related aquaculture activities while identifying location, species or operational-specific factors that may influence the extent of the impact on the environment in a particular situation.

Aquaculture Environmental Risk Management

There are five major elements in the Department's approach to managing the environmental risks that may arise due to aquaculture activities (Figure 1, below).

- (1) Defining the environmental and ecosystem objectives for aquaculture activities in Canada: these objectives are defined within legislation, through intergovernmental and international agreements, and consideration of societal values;
- (2) Issue identification: these can be identified through the results of scientific research, monitoring of environmental changes, and/or through public engagement;
- (3) Risk assessment: the science-based characterization of the likelihood and consequence of an activity and assessment of the overall risk, based on the current state of knowledge, and, the identification of uncertainty;
- (4) Risk management: this includes the assessment of how to address uncertainties through applying precaution measures and options for regulatory measures (mitigation and compliance/effects monitoring), and management decisions on mitigation, monitoring, and licencing; and,
- (5) Monitoring and evaluation of the activity against the identified risks.

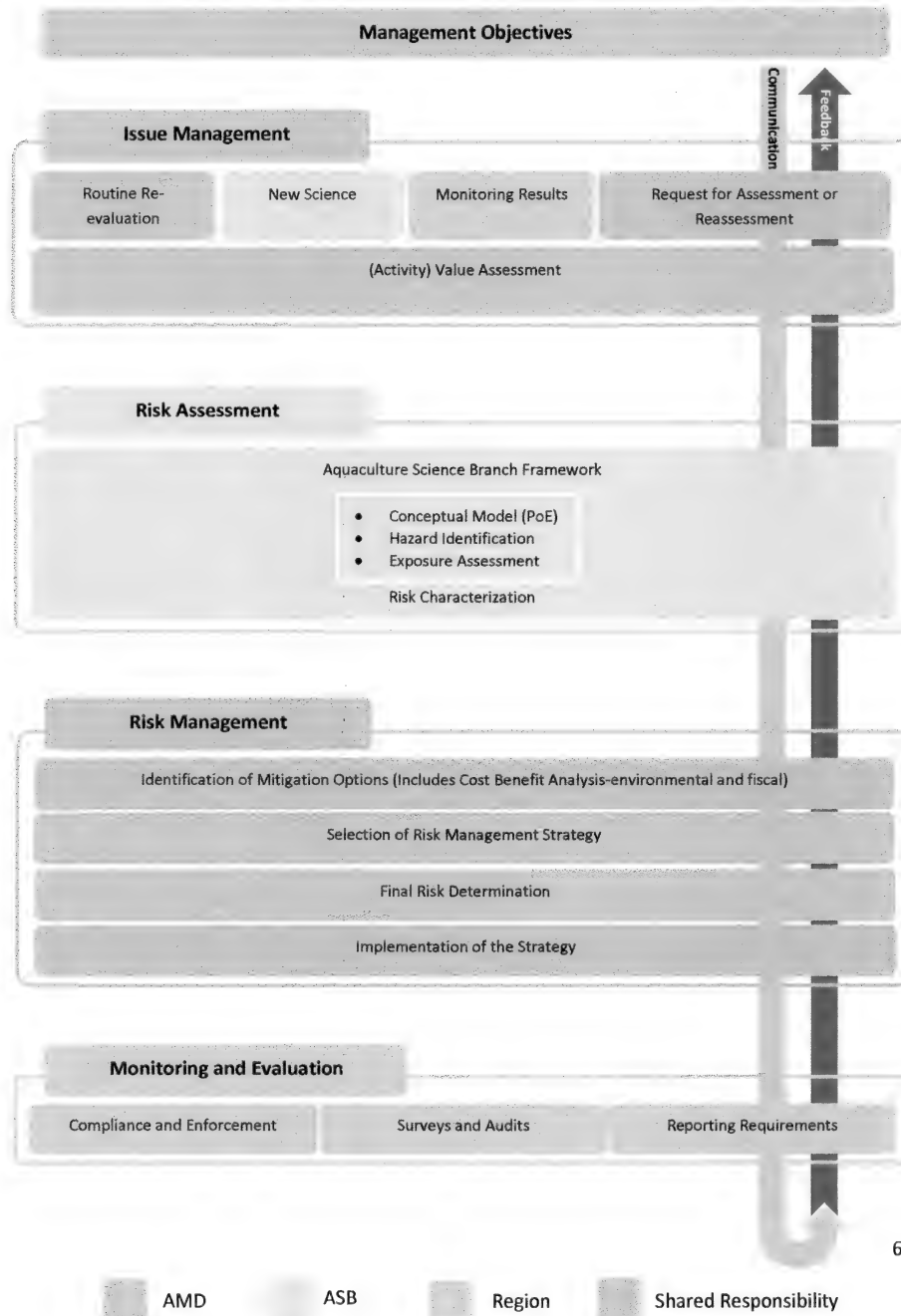
Throughout this process, communication and feedback are critical.

Integral to this process is that management decisions are based on many considerations, including, but not exclusively, scientific, social, economic and political. It is important to note that not all aquatic areas require equal levels of protection, as not all areas are equally ecologically or biologically significant or vulnerable.

³ A Fishery Decision-making Framework Incorporating the Precautionary Approach: <http://www.dfo-mpo.gc.ca/fm-gp/peches-fisheries/fish-ren-peche/sff-cpd/precaution-eng.htm>.

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Figure 1: Aquaculture Environmental Risk Management Framework



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Management decisions should also take it into consideration, as may be available, Indigenous Peoples traditional and ecological knowledge.

This approach supports management decision-making with respect to both (1) the setting of broad management (mitigation and monitoring) measures, such as siting criteria and general conditions on operations; and, (2) the consideration of individual applications (e.g., new or amended licences), focussing resources on risks that are unique to the proposed application.

Pathways of Effects (PoE) Model

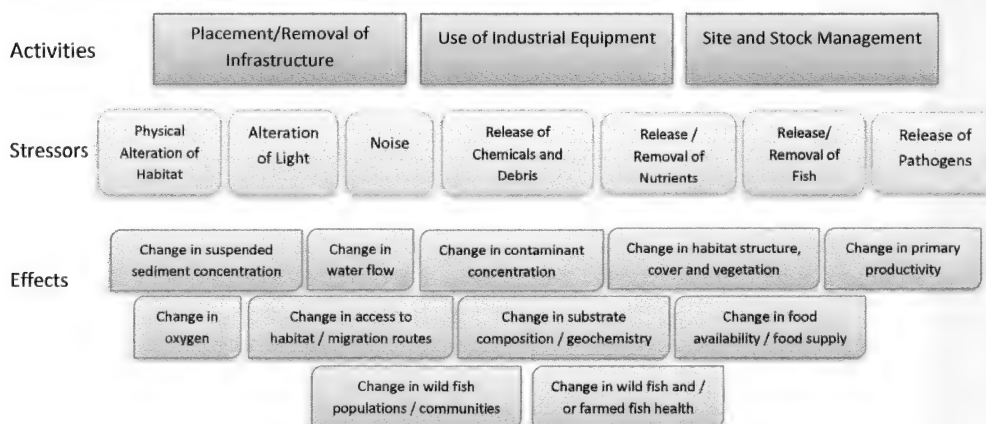
A Pathways of Effects (PoE) model is a tool that can convey complex interactions between human activities, the stress they can place on the environment (pressures), and environmental effects. The model operates on the premise that human activities can place stress on the environment which, in turn, can lead to various environmental effects. The model recognizes that a single environmental stressor can have multiple source activities and can lead to one or more environmental effects. It also recognizes that a single environmental effect can be influenced by one or more stressors or activities.

PoE diagrams group similar components together at each level in the model (activities, stressors and effects), noting inter-linkages in text descriptions of the environmental considerations. These diagrams and descriptions are designed to communicate information in a manner that facilitates the consideration of overall impacts on the environment, and the ecological benefits and costs of various potential management measures, including interactions between measures and cumulative impacts.

The scientific basis for links between aquaculture activities, stressors and effects was peer-reviewed through DFO's Canadian Science Advisory Secretariat process, and the summaries of the scientific state of knowledge for each of the stressors. This information is available for use in the evaluation of aquaculture activities and the identification of where management intervention may be required to protect fish and/or fish productivity/populations.

Figure 2: Pathways of Effects for Finfish and Shellfish Aquaculture

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At the specific aquaculture application level, the linkages between each of the stressors and the relevant effects are considered. The specific environment and activity will determine which stressor-effect linkages exist, and what mitigation measures can be used to effectively and sustainably break the stressor-effect linkages.

- **Physical alterations to the habitat** occurs when activities related to placing or removing physical infrastructure (e.g. net pens, longlines, rafts, anchors and moorings, shellfish beach culture structures), as well as during the use of husbandry equipment (e.g. underwater lights to increase growth in marine finfish or acoustic deterrent devices to discourage predators⁴).

The extent and impact of the predicted physical alterations to habitat are considered primarily during the pre-operational stage (e.g. site application), which includes an evaluation of the type of benthic habitat in the area being proposed for aquaculture.

- **Release of chemicals and debris** occurs primarily with activities associated with site and stock management, and the use of operational equipment where chemicals and debris may be released. Examples include the use of pesticides, drugs and antifouling agents, and the use of materials in construction (e.g. steel, wood, floatation) and operations (e.g. feed bags, ropes), which can be lost from sites as debris.

The effect of the use of pesticides, drugs and antifoulants on the receiving environment, including on non-target organisms, is assessed by Health Canada.

- **Release of organic and related matter** occurs as a result of stock management activities (e.g. the feeding and cultivation of fish, removal or natural sloughing of biofouling organisms from physical infrastructure) that have an organic or related component (e.g. nutrients).

The predicted extent of organic deposition on the surrounding seafloor is assessed at the pre-operational stage. As part of the on-going operational compliance, marine finfish aquaculture operations must meet a performance-based regulatory requirement related to the release of organic matter.

- **Removal of nutrients and organic matter** occurs as a result of stock management activities where some cultured species (e.g. bivalves) remove particulate matter, nutrients and oxygen from the water column.

The predicted extent of the removal of nutrients on wild populations is assessed at the pre-operational stage.

- **Release or removal of fish** occurs primarily as a result of stock management activities.

⁴ Note that the use of acoustic deterrent devices is not a current practice in Canadian aquaculture.

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The removal of fish is considered and managed as bycatch. This occurs when some individual wild fish may be temporarily or permanently removed from waters along with cultured fish (e.g. during grading or at harvest), or as part of biofouling or predator control.

The addition of fish to the environment occurs either as a result of intentional stocking of cultured fish into aquatic environments for cultivation (e.g. salmon enhancement), or as a result of unintentional release of fish (e.g. escapes).

The impact on wild populations from the unintentional release of cultured organisms is considered at the pre-operational stage, and is also linked to fiduciary responsibilities associated with the *Species at Risk Act*.

- **Release of pathogens and pests** occurs associated with site and stock management. The increase in biomass of fish within an aquaculture site can influence the presence or abundance of fish pathogens (e.g. bacteria, viruses) and pests (e.g. sea lice and tunicates).

The introduction of pathogens or pests is evaluated at the operational stage, primarily by the Introductions and Transfers Committees (ITC). Conditions of licence outline mitigation measures for the management of the abundance of pathogens or pests. Additionally, notifiable diseases are regulated by the Canadian Food Inspection Agency.

Additional details on the characterization of each of the stressors, the current status of regulatory thresholds, and current management and mitigation practices are found in Annex 1. Also, a case study for the management of sea lice in B.C. is found in Annex 2.

Stakeholder and Indigenous Peoples' Engagement

Stakeholder and Indigenous peoples' engagement to support sound aquaculture governance is critical. The lack of social licence is a major barrier to robust aquaculture growth. Other factors, including the type of regulatory regime or site-specific development capacity characteristics, may play a role, but not to the extent of societal acceptance. The best mechanism for sustainable growth is via coastal zone and area-based management approaches which fully engage interested stakeholders and indigenous groups, who may actually contribute to decision-making. These processes not only support general agreement of where sites should go, but also the areas of greatest concern to focus on.

It should be recognized that some risks are new or emerging, and the evolution of scientific knowledge may influence society's tolerances and its chosen level of protection. An understanding of the "public's tolerance for risks" or "society's chosen level of protection" underpins the need for high transparency, clear accountability, and meaningful public involvement and communication.

Commented [D1]: There is not a complete lack of social licence. The absence of social licence refers only to a segment of the Canadian population who object to aquaculture. This segment exists mainly in British Columbia

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Two-way sharing of information and the inclusion of a range of perspectives in the decision-making process can become the cornerstone of openness and transparency, and enhance credibility of and trust in the decisions that the Government develops.

Conclusion

DFO has managed aquaculture over the years based on managing environmental impacts and the potential risks these can pose to fish habitat and fish populations, as identified through the DFO peer-reviewed science process. Where relevant, DFO regulators strive to develop management standards or thresholds, which are informed by science, based on best practices globally, and have received some form of stakeholder and indigenous peoples' input.

Aquaculture management is a shared responsibility between the federal and provincial governments; thus, management frameworks need to be foundationally the same. In circumstances where there is a potential for unacceptable harm to fish (population-level effects), it may be appropriate to make decisions and implement precautionary measures in the near term, without having full certainty of the probability or magnitude of harm. Close monitoring would also occur to assess the effectiveness of the measures in addressing risk and overall impacts. Follow-up activities, including research and monitoring, are key to reducing scientific uncertainty and allow improved decisions to be made in the future. Finally, stakeholder and Indigenous peoples' engagement throughout the risk management process is critical, not just at the final decision-making process.

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Annex 1: Details on Aquaculture Stressors, Effects and Risk Management

STRESSOR	THRESHOLD	MANAGEMENT ACTION / MITIGATION
<p>Release of pests and pathogens</p> <p>Pathogens can be endemic in wild fish populations (i.e., occur naturally in wild populations in a region) or exotic (i.e. occur naturally in other locations and have been introduced in a region). The presence of endemic pathogens can be amplified under some circumstances where fish are in close proximity (e.g. spawning grounds, schooling and aquaculture). Endemic pathogens tend to have a less severe effect on native populations than exotic (or introduced, non-endemic) pathogens, as over multiple generations native species have typically developed an immune response to endemic pathogens.</p> <p>The health status of wild fish often cannot be directly assessed, and changes in wild fish populations or communities due to disease are difficult to determine. Diseased and moribund fish are quickly removed from the population through processes such as predation or mortality; sampling can therefore be easily biased toward healthy individuals. The presence or absence of pathogens is particularly difficult to determine in wild fish populations, nor is there available scientific data to determine the effect of low level presence of pathogens at the individual or population level.</p>	<ul style="list-style-type: none"> Sea lice threshold (B.C. only); Mandatory Reporting of Fish Health Events (i.e., treatment or % loss) (B.C. only) 	<p>Conditions of licence require treatment for sea lice above threshold (3 lice/fish in B.C.)</p> <p>Monitoring fish health is a particularly important mitigation tool when cultured fish are destined for movement to another location or for release into aquatic environments. The determination of the appropriateness of planned movements or releases of fish must be based upon a review of the disease and mortality history of the cohort, on recommendations by a qualified fish health professional, on the results of any recommended pre-release disease screening, and on guidance from regulatory agencies.</p>
<p>Release (or removal) of organic matter and nutrients</p> <p>Potential sources of the release of other organic matter include fish carcasses (e.g. from cultured fish or bycatch⁵), feed spillage, faeces,</p>	<ul style="list-style-type: none"> BOD threshold 	<p>Footprint addressed through initial siting decisions (benthic impact depositional modeling)</p> <p>Performance based threshold (on-going assessment once/production cycle) – under the AAR, sites cannot be restocked</p>

⁵ The release of incidental finfish catch during finfish harvest, as may be required under conditions of licence, may contribute to organic matter in the environment if the fish are dead or have a low chance of survival.

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<p>harvest waste or offal, including blood. Release of organic matter into the marine environment from humans working and/or living on site could also constitute a minor contribution of organic matter to aquatic environments, should it occur. Human waste is generated on boats or in working or living accommodations as part of daily activities like cooking, bathing and bodily functions. The majority of organic matter introduced into the environment from finfish aquaculture will be associated with excess feed and faeces. Accumulation of the organic matter can result in a change in the benthic biodiversity around a site.</p>		<p>if sulphide threshold exceeded</p>
<p>Release of chemicals/drugs</p> <p>Pesticides are assessed by the Pest Management Regulatory Agency of Health Canada for value of use, human, animal and environmental risks under the <i>Pest Control Products Act</i>. Factors considered in environmental risk assessments related to pesticides include the potential transport and dispersal of products and/or their constituents following release into waters, as well as the exposure of non-target organisms to concentrations of substances that could result in lethal or sub-lethal (e.g. behavioural, reproductive) effects. The severity of impacts on exposed non-target species will depend on factors such as the toxicity of the product used, the dosage, the presence of susceptible non-target species / life stages of species, and environmental conditions.</p>	<ul style="list-style-type: none"> No thresholds – Research and analysis underway to provide advice on the design of a post-deposit monitoring program. 	<p>PRMA-PMRA can place limits on the timing, location and volume of the release of specific materials.</p> <p>Under development – traffic light system for 1) pre-siting assessment to inform site placement, and 2) cumulative impacts (informed by post deposit monitoring program (site level) and aquaculture monitoring program (bay scale))</p>
<p>Physical alteration of habitat</p> <p>The addition, removal, and</p>	<ul style="list-style-type: none"> Maximum shellfish aquaculture coverage of 7% per bay in some areas of Canada 	<p>Primarily addressed through initial siting considerations.</p> <p>In situations where wild fish may be</p>

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modification of physical structures may affect bottom sediments, benthic communities, pelagic communities, and hydrodynamics.		present only on a seasonal basis, or where habitat is used by a species during a particular period (e.g. during reproductive phases), measures to limit the duration, timing or extent of installation, harvest or site maintenance activities may be warranted.
<p>Release (or removal) of fish</p> <p>Farmed finfish, including salmon, may escape, usually due to equipment failure or human error. Equipment failure may be weather-related, caused by predator attacks or other events that stress the containment infrastructure. For there to be genetic intrusion, establishment of non-native populations, predation or competition, farmed fish must first be released into the wild through escape or the release of viable gametes.</p>	<ul style="list-style-type: none"> • Reporting of escapes may be required, depending on jurisdiction • No <i>direct</i> genetic impact risk on West Coast from Atlantic salmon farms 	<p>Addressed through conditions of licence and development of national containment standards (to be developed)</p> <p>Regulation of fish containment structures and use of triploid farmed fish would further lower the extent of direct genetic interaction.</p> <p>In the event that an unintentional release does occur, measures such as escape response plans may help to recover released fish., particularly where a significant risk of harmful interaction with wild populations has been identified.</p> <p>Escape reporting and analysis of the measures employed may be used to help assess the effectiveness of current mitigation measures and develop future facility or regulatory measures, as appropriate. Measures for recording and reporting cultured fish inventories as well as accurate records of introductions and transfers of licensed species support a broader understanding of the scope (estimated quantity, species and timing) of unintentional releases, and may form part of the management approach in mitigating their effects.</p> <p>In circumstances where a new species is being considered for rearing in an area for the first time, a specific environmental risk assessment is warranted to determine whether or not an Introductions and Transfers licence should be issued (see National Code on Introductions and Transfers LINK). The Code provides guidance that the I&T risk assessment should typically focus on incremental risk aspects that are particular to that species. Species identified as higher risk may have special regulatory conditions imposed on</p>

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		<p>them to bring the risk to an acceptable level. Where risk outcome warrants, some species may not be authorized for culture. An I&T risk assessment may also be warranted where a species is native to the province but new to culture. In terms of risks related to release of fish, the assessment should start by focussing on the probability of the cultured gametes interacting with wild fish populations, and in the case of finfish, the potential for escaped fish to interact and compete with populations of the same or other species.</p>
<p>Noise</p> <p>Noise associated with aquaculture operations may be produced incidentally during the routine operation of equipment such as aerators, feeders, generators and power washers, and by vessels servicing aquaculture facilities. The effects of such noise are expected to be localized, short-term and likely insufficient to cause injury or permanent displacement to marine organisms.</p>	None	<p>Addressed through initial siting considerations and conditions of licence</p>
<p>Alteration in light</p> <p>Measurements of light penetration around net pens show that little visible light is found outside the pens, which suggests that the use of lights in aquaculture will have minimal and mainly local ecological effects.</p>	None	<p>Addressed through initial siting considerations and conditions of licence</p> <p><i>In B.C. is there still a requirement to report the use of lights?</i></p>

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Annex 2: A Case Study- Management of the salmon louse ~~Sea Lice~~ in B.C.

1. Description of Stressor and Potential Impact – Sea Lice

Environmental

The release of pathogens or viruses from aquaculture facilities through site and stock management is a stressor described in the Canadian Science Advisory Secretariat (CSAS) research document “Pathways of Effects for Finfish and Shellfish Aquaculture” (PoE). The primary effect associated with this stressor, as described in the PoE, is a change in wild fish and/or farmed fish health. Additional sea lice specific science advice has also been provided, and this case study and analysis draws on this advice⁶.

Sea lice are endemic to the Pacific Coast and are found on several species of Pacific salmon and non-salmonid species. They are also present in other areas of the world where Atlantic salmon reside, such as Norway and Scotland. There are a number of sea lice species throughout the world that have a range of hosts and life cycle characteristics. The species of sea louse that is regulated ~~concern~~ in B.C. ~~from an aquaculture perspective is the~~ Lepeophtheirus salmonis (the Salmon-salmon louse); however, ~~there is~~ another species, Caligus clemensi (Hthe herring louse) ~~which can occasionally occurs cause concern~~ in aquaculture facilities. Regardless of species, ~~the~~ sea lice life cycle includes numerous stages, such as: the free-floating Anauplius stages, infectious copepodid stage, attached chalimus stages, and finally the motile stages (pre-adults, adults).

Farmed Atlantic and Pacific salmon are stocked at the marine sites free of salmon lice and infection occurs by exposure to passing adult wild salmon. This is known as “spillover.” The intensity of infestation on farmed salmon is based on a number of factors including the size of the wild salmon run, sea water temperature, salinity and the health of the farmed fish. Cultured Pacific salmon are less susceptible to salmon ea-lice infestation than Atlantic salmon. When infestation occurs at a farm the sea lice numbers may become internally amplified, which may result in “spillback” to wild salmon. Elevation of salmon louse infestation may be harmful to ~~Of particular concern is the effect this may have on juvenile salmon smolts which have recently entered the marine environment and as they are most susceptible to sea lice. Wild salmon smolts out-migrate from their natal streams during the spring and early summer. A corresponding “out-migration window”, from March 1st to June 30th with more stringent different requirements for management of lice levels, is incorporated into the farm licence conditions. The out-migration window as currently defined runs from March 1st until June 30th annually.~~

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⁶ Assessment of Sea Lice Monitoring and Non-Chemical Measures, DFO 2014 SAR 2014/006

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Social

There is a high level of concern from a segment of the public, some First Nations and ENGOs, on the impact aquaculture has on wild Pacific salmon, and more specifically on the belief that sea lice can significantly negatively impact wild salmon populations. Wild salmon populations can be highly variable and in some cases a low run in one year can be followed by record high numbers; this happens in areas both with and without aquaculture facilities on migratory routes. Conflicting opinion about the possible impact of high levels of sea lice has not given these groups, governments, the media or the Canadian public a level of comfort that the Department is properly managing the risk the aquaculture industry may pose to wild salmon.

Commented [D2]: An elevated level of comfort may be achieved through more effective communication strategies that high-light what is being done to manage salmon lice. Also years ago, DFO ran an annual sea lice surveillance program on juvenile wild salmon in the Broughton – and posted the monthly results on-line. This kind of information established what are the normal levels of lice on juvenile salmon, what constitutes high levels, and how often high lice levels occur.

2. Current Management and Mitigation – Sea Lice

The goal of the current management approach is to ensure that no disease or disease agent negatively impacts the protection and conservation of fish. Presently, risk related to sea lice is managed through licence conditions and the Fish Health auditing program.

Pre-Operational Management Approach

The Precautionary Approach is applied during the consideration of new sites, both from a site-specific and broader area perspective. This is also true for applications for increased production at an existing site. There is recognition of the potential risk of increased sea lice abundance and corresponding infection of out-migrating salmon from licenced facilities as a result of increased salmon production at the farm or area level. Assessments including the history of sea lice abundance levels at that farm and neighbouring farms in the general area include recommendations for mitigation measures, such as area-based management (e.g. coordinated and timing of stocking, fallowing and sea lice treatments), maintenance of single-year classes, practicing integrated pest management, and timing of stocking to reduce the need for sea lice treatments. Geographic elements considered during the assessment include ~~hydro~~-connectivity between the proposed site and adjacent farms, and proximity to known salmon migration routes.

~~When siting new facilities,~~ Efforts are made to avoid the siting of new aquaculture facilities in areas which are known to be important wild fish migration routes, nurseries, sensitive habitats, or have other importance to wild fish populations or significant to First Nations. Ongoing science and research forms part of this consideration.

Current Operational Management Approach

The licence conditions include sea lice monitoring protocols as well as sea lice abundance thresholds that a licence holder cultivating Atlantic salmon must abide by. The cornerstones of sea lice management in BC are routine monitoring and the application of a management

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threshold. During the outmigration period, sea lice counts are conducted by industry sampling on farms is required at least every two weeks at minimum during the out-migration period. During this time, and DFO conducts sea lice audits by sampling auditing of the reported numbers and sampling methodology occurs on 50% of all active farms during this time. For the remainder of the year, sampling by industry is only required once per month. The sea lice management threshold is ,but will increase to every two weeks if threshold levels three motile (pre-adult and adult) lice (*Lepeophtheirus salmonis*) per fish are exceeded. This threshold is set at an average of three motile (pre-adult and adult) lice (*Lepeophtheirus salmonis*) per fish. During the outmigration period, During the outmigration window, salmon farmers are required to maintain lice are maintained levels below the three motile lice threshold level, typically by harvesting or treatment. Outside this period, there is no they are not obligation that farmers must maintain levels below the ed to maintain this threshold, but must notify DFO must be notified when the threshold is they exceeded and develop a mitigation strategy must be developed for consideration by DFO officials. This system allows for lice control during the sensitive out-migration period, but does not require treatment outside this period, thereby reducing the use and potential development of resistance to various sea lice therapeutants. Sea lice sampling on farms is required every two weeks at minimum during the out-migration period, and DFO auditing of the reported numbers and sampling methodology occurs on 50% of all active farms during this time. For the remainder of the year, sampling by industry is only required once per month, but will increase to every two weeks if threshold levels are exceeded.

Mitigation

Companies are increasingly moving towards an area-based management approach where all smolts in a given area are the same year-class and, if treatments are required, they are coordinated among between these sites. Treatments are ideally timed in coordinated with the migration of returning adult wild fish so that all wild fish have left the area before treatment is initiated. This is to avoid reinfection and retreatment which can lead to resistance. Currently the primary sea lice treatment is the use of emamectin benzoate (SLICE), which is an in-feed parasiticide.

Recently in some areas in B.C., SLICE there is evidence that salmon lice have elevated resistance to SLICE has emerged in recent years. Industry is rapidly developing integrated pest management strategies alternative treatment modalities to curtail SLICE resistance, and prevent the development of wide-spread resistance in the sea lice population in B.C. These include involves the rotational use of alternative treatment methods, such as novel in-feed parasiticides, hydrogen peroxide baths and/or mechanical sea lice removal (e.g. Hydrolicer). An alternate method of reducing absolute sea lice inventory is through harvesting, which typically would occur when fish are near harvest weight. This method is only effective if harvesting is

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done at a rate that reduces a farm's permissible absolute sea lice inventory (as defined in the licence).

3. Scientific Certainty – Sea Lice

A large number of scientific studies have been conducted in recent years which have tried to determine what, if any, harm is posed to wild salmon by sea lice spillback from Atlantic salmon farms. No conclusive evidence has been found to suggest that sea lice originating from farms are causing harm to wild stocks on a wide scale. This has largely been accepted by stakeholders and opponents to the salmon farming industry. This indicates that the three motile threshold is sufficiently conservative to mitigate risk to wild salmon posed by sea lice originating from farms. In the rare instances where farms have not been able to control lice levels during the out-migration period ~~(often as a result of SLICE resistance)~~, lice levels are found to be higher on out-migrating salmon smolts. This indicates that lice management on farms is vitally important to prevent potentially harmful ~~an undue~~ lice burdens on wild smolts.

Commented [D3]: Failure of SLICE treatments has not always been due to resistance.

4. Residual Risk and Application of the Precautionary Approach – Sea Lice

Environmental

A changing climate may makes future lice mitigation more uncertain and challenging. The effects of in years with warmer water temperatures and increased salinity on the management of lice are poorly understood and should be the focus of research. ~~becomes more difficult. This is likely to become more common as time progresses. The limited availability of sea lice treatment options in BC inevitably led to increased evidence of resistance to SLICE, as has been observed in many other jurisdictions around the world. Additionally, the emergence of SLICE resistance on B.C.'s coast has presented a significant challenge to industry for effective lice management. However, The adoption of alternative additional treatment strategies options by industry is very welcome and indicates has demonstrated that lice levels can should be able to still be effectively managed controlled, despite a changing climate and without sole reliance on SLICE. Effective management is vital to ensure that wide spread resistance to lice therapeutants does not occur as it has in other jurisdictions. Ongoing research into the genetic determinants of lice resistance, use of cleaner fish, alternative treatments and alternative cage designs/husbandry methods are all very promising, and should be encouraged and supported to allow proactive management by industry. Under the present management regime, the residual risk once operational is determined to be medium.~~ Application of the Precautionary

Commented [D4]: A formal risk assessment for sea lice should be conducted. To my knowledge, this has not yet been done and this document should make no statement that suggests otherwise.

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Approach requires that the Department utilize existing and potential new management measures to ensure that the risk stays within an acceptable range.

Context	Risk Attributes			
		High	Moderate	Low
	High	-	-	-
	Moderate	-	X	-
	Low	-	-	-

Social

Based on the level of scientific certainty that sea lice are not causing harm to wild fish populations the level of concern raised by the public is expected to diminish over time. Due to the variable nature of salmon returns there may continue to be a perception that declines in salmon populations are related to sea lice impacts. As noted above, uncertainty environmental residual risk exists based on changing climate conditions. It is incumbent on DFO to ensure a robust scientific program remains in place to better understand how the change in climate conditions is affecting sea lice, and their interaction with farmed and wild fish. If this scientific research along with changing management requirements (as necessary) is communicated to the public in a pro-active manner, social acceptance should increase.

Commented [D5]: Public concern will be diminished through the application of effective communication strategies

Commented [D6]: Effective communication of risks to wild salmon from other human activities (e.g. fisheries) are also required.

Commented [D7]: This table implies a risk assessment has been undertaken – which to my knowledge is not the case.

Context	Risk Attributes			
		High	Moderate	Low
	High	-	-	-
	Moderate	-	X	-
	Low	-	-	-

5. Next Steps and Future Developments – Sea Lice

DFO conditions of licence relating to lice have been found to be vague, outdated and sometimes unenforceable. Some preliminary ideas on changes to the licence to allow better regulation, while also providing additional tools and guidance to industry, include:

Commented [D8]: Who found this? This statement requires more context and detail.

- Consider moving to adult female-based threshold, rather than current motile threshold.

Commented [D9]: Norway uses an all female threshold. In Norway they are still challenged to manage lice levels. Our motile threshold is more robust because it includes male and female adult and preadult stages

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- Establishment of a farm-based, in addition to a fish-based (as currently used), sea lice threshold (For example, we assume 500 000 fish on farm, with three motiles = 1.5 million lice allowable on a single farm).
- Harvest alone would no longer be deemed an appropriate management action within the out-migration [would only be used to lower farm-based "absolute sea lice inventory" below farm-level threshold (as mentioned above) before entry into out-migration].
- Change licence condition of "active farm" away from number of pens stocked (more than 3), to absolute number of fish on site for a given time (e.g. active site could be defined as: more than 30 days have passed since the introduction of more than 50 000 fish to a sea site).
- Consideration be given to initiating mandatory sea lice reduction prior to March 1, which is the generic time when out-migration is recognized to start, as stated in licence conditions.
- Implement mandatory post in-feed lice treatment reporting to better monitor efficacy.
 - E.g. 25-30 days have passed since the completion of treatment with an in-feed parasiticide medication.
- Implement prohibition on use of lice chemical therapeutant for a time in response to resistance.
 - E.g. treatment failure could be defined as: "failure to achieve > 60% reduction in pre-treatment lice numbers at the 25-30 day post-treatment counts".
- SLICE use would be prohibited at that site again during the calendar year.

Commented [D10]: Existing industry treatment data show most treatments are initiated well before the outmigration window

Moving forward The Department must continue to participate in global networks of sea lice researchers, and focus its research efforts on relevant areas including ~~do scientific research on sea lice interactions between and its relationship to farmed and wild salmonids in the context of climate change in order to develop a clearer understanding of the possible linkages between the two and the corresponding risk to cultured and wild fish, and the development of alternative sea lice management strategies.~~ It should also be cognizant of, review related independent science (science which comes from sources outside of DFO), and react to key new findings by adjusting our research objectives. Operationally DFO must adapt to new science, making changes to present management approaches as necessary.

Although the risk posed by sea lice to juvenile wild salmon is considered low based on our present scientific understanding, a Precautionary Approach to the siting of new farms in the future could incorporate the potential of sea lice becoming a higher risk because of changing environmental conditions.

Over and above the current operational management approach it is recommended that a risk-based traffic light system be implemented that would be tied to some objective measure of sea

Commented [D11]: There is a need to thoroughly discuss the traffic light (i.e., the Norwegian system) management approach, and whether it, or a modified traffic light approach to sea lice management will work in BC

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lice abundance (e.g. number and severity of exceedances). This approach could amalgamate information from an individual farm or a number in a geographic area that have hydro-connectivity. It is well established that sites which have good overall fish health performance, including a low sea lice burden, are less likely to become susceptible to disease.

Commented [D12]: Alternatively, recognition of clear differences in sea lice risk on farms among management areas in BC indicates the potential value of region-specific management strategies.

A green designation would indicate that historically a site has good sea lice management with rare incidences of threshold exceedance and low or negligible mortality indicating a low residual risk to wild salmon. The Department could consider increases in production at these sites. A yellow designation would indicate some recurrent sea lice threshold exceedances that are able to be managed on site without the risk of associated fish health issues and do not represent a notable threat to wild salmon. Increases in production would not be considered and additional management measures may be required. A red designation would indicate serious, significant or repeated sea lice exceedances that could potentially represent a notable threat to wild salmon. Drastic management measures could include reducing authorized production, a requirement to fallow for a significant time period, or cancellation of the licence.

At present there is a lack of flexibility in the licence conditions to require actions such as those outlined for farms designated red as the Department does not have the legislative authority. Moving forward the Department should pursue legislative/regulatory changes to obtain this authority.

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APPENDIX I: Marine Finfish Pre-Operational Risk Table

There are a number of elements that are already assessed at the pre-operational application stage and the risks are summarized for senior management in a table.

Farm name:	Company:			
Elements Assessed – Wild Fish and Fish Habitat	Low	Med	High	N/A
Presence/use and interactions with CRA fishery or rare species				
Presence of important fish habitat (e.g. sponge reefs, rockfish nursery, etc.)				
Presence/use and interactions with SARA listed species				
Appropriate distance to salmonid-bearing streams				
Appropriate distance to important herring spawn areas				
Appropriate distance to shellfish beds				
Appropriate depth, currents and benthic substrate				
DEPOMOD predictions acceptable				
Existing seabed conditions (e.g. capable of assimilating waste)				
Historic benthic monitoring results				
Use of lights				
Marine mammal usage & mitigation				
Elements Assessed – Fish Health	Low	Med	High	N/A
Diseases of concern on farm, nearby farms, and in area (if known)				
History of appropriate disease management on farm and nearby farms				
Prudent history of medicant use (if known)				
Hydrological connectivity with other farms & co-management plan(s)				
History of compliance and reporting on FH and SL				
Adequacy of submitted FHM, SOPs and Carcass Management Plans				
Water quality (e.g. DO, water flow; if known) & mitigation				
Natural challenges (e.g. plankton issues, harmful algal blooms; if known) & mitigation				
Fish density appropriate to maintain good FH (if known)				
Species intended to be grown is appropriate for the area				
History of predator stress & mitigation (if known)				
Elements Assessed – Sea Lice	Low	Med	High	N/A
Natural occurrence of sea lice at site				
History of staying below sea lice thresholds during smolt out-migration				
Appropriate use of available tools to manage sea lice in future				
Elements Assessed – Existing Fisheries	Low	Med	High	N/A
CSSP closure on bivalve shellfish beds used in CRA fisheries				
First Nations FSC fisheries/site access				
Commercial fisheries (direct or indirect displacement – reduction in stock				
Recreational fisheries (direct or indirect displacement – reduction in stock				
EFA/test fishery/research area				
Geoduck beds				

Jones, Simon

From: Hyatt, Kim
Sent: Wednesday, September 26, 2018 3:40 PM
To: Higgins, Mark; Johnson, Stewart; Sutherland, Terri; Therriault, Thomas; O, Miriam; Coyle, Theraesa; Pearce, Chris; King, Jackie; Robinson, Cliff; Neville, Chrys; Miller-Saunders, Kristi; Jones, Simon; Garver, Kyle; Chandler, Peter; Bianucci, Laura; Murray, Cathryn; Dobson, Diana; MacWilliams, Christine
Cc: Lowe, Carmel; Holmes, John; Kennedy, Eddy; Houston, Kim; MacDougall, Lesley; Thiess, Mary
Subject: RE: Aquaculture Risk Management Framework and the Application of the Precautionary Approach
Attachments: Aquaculture-doc_kdhcomments.docx
Follow Up Flag: Follow up
Flag Status: Completed
Categories: Yellow Category

Hi Mark! My comments provided in margins of attached document. Let me know if they require any clarification.

Regards, Kim.

Kim D. Hyatt Ph.D.
Section Head, Regional Ecosystem Effects on Fish and Fisheries
Science Branch, Ecosystem Science Division, Fisheries & Oceans Canada
Pacific Biological Station, Nanaimo, BC V9R 6N7
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Associate Editor, *Canadian Water Resources Journal*, NRC Research Press

From: Higgins, Mark
Sent: September-26-18 12:36 PM
To: Johnson, Stewart; Sutherland, Terri; Therriault, Thomas; O, Miriam; Coyle, Theraesa; Pearce, Chris; King, Jackie; Robinson, Cliff; Hyatt, Kim; Neville, Chrys; Miller-Saunders, Kristi; Jones, Simon; Garver, Kyle; Chandler, Peter; Bianucci, Laura; Murray, Cathryn; Dobson, Diana; MacWilliams, Christine
Cc: Lowe, Carmel; Holmes, John; Kennedy, Eddy; Houston, Kim; MacDougall, Lesley; Thiess, Mary
Subject: FW: Aquaculture Risk Management Framework and the Application of the Precautionary Approach
Importance: High

Dear all,
Some of you have already been contacted with this request, but I wanted to ensure everyone is on the same page. Please find attached the document on which Ottawa is looking for comment. See below for further details. There may be a call/meeting to discuss any comments received sometime next week, so if you could pass any comments to me by Tuesday, October 2nd, that will give us time to assess how to proceed from there. We are hoping that we can get comments from as many as possible before returning this to Ottawa. If you have any questions, please let me know.

Thanks

Mark Higgins
A/Division Manager ADGT
Fisheries and Oceans Canada / Pêches et Océans Canada

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From: Lowe, Carmel
Sent: September-19-18 12:05 PM
To: Higgins, Mark; Holmes, John; Kennedy, Eddy
Cc: MacDougall, Lesley; Houston, Kim; Patten, Bruce
Subject: FW: Aquaculture Risk Management Framework and the Application of the Precautionary Approach
Importance: High

All – see below and attached.

Mark – I would like you engage the others on this email and provide me with a list of the staff that should be included in a review of this draft approach. I propose we then convene a meeting of those staff and those on this email to conduct the review and provide a consolidated response back to Jay and Ingrid. Let me know if there are any issues/concerns with this proposed approach – and if so, what are alternate suggestions completing the review.

I will ask Catherine to find a time for this regional review meeting during first week of October. I am guessing we will require 2 hours.

Carmel

Carmel Lowe, Ph.D.
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From: Parsons, Jay
Sent: September 19, 2018 11:48 AM
To: McCallum, Barry <Barry.McCallum@dfo-mpo.gc.ca>; Vézina, Alain <Alain.Vezina@dfo-mpo.gc.ca>; Bliss, Doug

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Subject: Aquaculture Risk Management Framework and the Application of the Precautionary Approach

Importance: High

Le français suit

Colleagues,

As mentioned Monday, a draft Aquaculture Risk Management Framework/Application of the Precautionary Approach has recently been developed, in response to the Minister's request that the Department explain how aquaculture is managed and how the precautionary approach is applied. This supports a number of high profile and public expectations, including the Cohen Commission report, the Minister's mandate letter and the Spring 2018 report from the Commissioner for the Environment and Sustainable Development.

It is important to note that this document is very much still a work in progress. For example, the intention is to balance this document nationally by including additional examples in Annex 2 incorporating east coast applications.

Prior to engaging with the Provinces, Territories and Indigenous Peoples, comments and feedback internally is being sought. Aquaculture Management sent out a version Tuesday to their RDs seeking their comments on the applicability of the framework to aquaculture, and changes and/or improvements.

The attached version is the most recent and current version and should be used for the purpose of review. Unfortunately, it is currently only available in English; the translated version will be sent when it becomes available.

Aquaculture Management has requested feedback by **Friday October 12, 2018**. Therefore, the comments from EOS will also need to be submitted by that time as well.

We ask that you broadly engage the DFO Science community within your region (i.e., in addition to aquaculture staff, also fisheries science and habitat science staff, etc.).

Please send your collated comments, corrections and suggestions to Ingrid Burgetz and Jay Parsons, with a cc to Wayne Moore by October 12th. Ingrid and Ed Porter from Aquaculture Management will then integrate all the comments into the next version. As well, we have been asked to convene a departmental technical review meeting of the document with internal (Science and Management) and external experts. We will soon be approaching you for suggested regional participants (Aquaculture / Fisheries / Habitat Science). This will also be an additional or alternate approach to providing regional input into the document.

Next steps following this include:

- DFO finalization of the document for external consultation, including presentation to the Minister
- DFO Science & Management internal and external technical review (details to be shared shortly)
- Consultations with P/T through the Canadian Council of Fisheries and Aquaculture Ministers

- Industry consultation
- Indigenous consultations
- Public consultation (on DFO website)
- Final posting on DFO's website

Thank you very much to your collaboration and support.

I apologize for the tight timelines, but this file has the express interest of the Minister.

Chers collègues,

Comme mentionné lundi, une ébauche du cadre de gestion des risques liés à l'aquaculture et de l'application de l'approche de précaution a récemment été élaborée en réponse à la demande du ministre voulant que le Ministère explique la façon dont l'aquaculture est gérée et dont l'approche de précaution est appliquée. Cela appuie un certain nombre d'attentes publiques de premier plan, y compris le rapport de la Commission Cohen, la lettre de mandat du ministre ainsi que le rapport publié par la commissaire à l'environnement et au développement durable au printemps 2018.

Il est important de mentionner que ce document est loin d'être définitif. Par exemple, pour que ce document soit équilibré à l'échelle nationale, nous souhaitons inclure à l'annexe 2 d'autres exemples d'application sur la côte est.

Avant de collaborer avec les provinces, les territoires et les peuples autochtones, nous désirons d'abord obtenir des commentaires à l'interne. Mardi, l'équipe de la Gestion de l'aquaculture a envoyé une version du document à ses directeurs régionaux afin d'obtenir leurs commentaires sur l'applicabilité du cadre à l'aquaculture, ainsi que des suggestions de modifications ou d'améliorations, le cas échéant.

Vous trouverez ci-joint la version la plus récente sur laquelle vous devez vous baser pour effectuer votre examen. Malheureusement, elle n'est disponible qu'en anglais pour le moment; vous recevrez la version traduite dès qu'elle sera prête.

L'équipe de la Gestion de l'aquaculture a demandé que les commentaires soient fournis d'ici le vendredi 12 octobre 2018. Les commentaires des Sciences des écosystèmes et des océans doivent donc aussi être soumis d'ici cette date.

Nous vous demandons de mobiliser, en plus de votre personnel d'aquaculture, la communauté scientifique de Pêches et Océans Canada (MPO) de votre région (le personnel scientifique des pêches et de l'habitat, etc.).

Veuillez envoyer vos commentaires, vos corrections et vos suggestions à Ingrid Burgetz et Jay Parsons, avec copie conforme à Wayne Moore, d'ici le 12 octobre. Ingrid et Ed Porter de l'équipe de la Gestion de l'aquaculture intégreront par la suite tous les commentaires reçus dans la prochaine version. De plus, on nous a demandé de convoquer une réunion d'examen technique du document avec des experts internes (scientifiques et gestionnaires) et externes. Nous vous contacterons bientôt pour des participants régionaux (Science de l'aquaculture des pêches ou de l'habitat). Ce sera également une approche supplémentaire ou alternative pour fournir une contribution régionale au document.

Par la suite, les prochaines étapes seront les suivantes :

- Le MPO finalisera le document aux fins de consultation externe et de présentation au ministre.
- Les équipes des sciences et de la direction du MPO effectueront un examen technique interne et externe du document (les détails seront fournis sous peu).
- Des consultations seront menées auprès des provinces et territoires par l'intermédiaire du Conseil canadien des ministres des pêches et de l'aquaculture.

- L'industrie sera consultée.
- Les peuples autochtones seront consultés.
- Le grand public sera consulté (par l'entremise du site Web du MPO).
- La version définitive du document sera affichée sur le site Web du MPO.

Je vous remercie grandement pour votre collaboration et votre soutien.

Je tiens à m'excuser pour les délais serrés, mais ce dossier est d'un grand intérêt pour le ministre.

Jay

On behalf of SRS and EOSS

Jay Parsons, PhD

Director

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SEPTEMBER 18, 2018 DRAFT

Application of the Precautionary Approach within a Risk Management Framework for Aquaculture

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Introduction

Globally, aquaculture continues to grow faster than other major food production sectors, and has been identified by the FAO, as a critical contributor to food, nutrition and employment in the global economy.¹ The Government of Canada recognizes aquaculture's significant benefits to society, including providing full-time jobs in coastal Canada. In Canada, aquaculture is a relatively new industry and is jointly managed by the federal and provincial governments. There is tremendous potential for the Canadian industry to become an even greater player in overall world production. However, societal conflicts over which human activities are acceptable in Canadian waterbodies have created challenges to the growth and sustainability of aquaculture in Canada. This is often expressed as environmental sustainability concerns, ranging from direct environmental impacts to indirect impacts on wild fish health and productivity. A well-defined risk management framework, which embodies a clear understanding of unacceptable harm, taking precautionary steps where relevant and fully engaging the public throughout the entire risk-management process can help to clearly communicate where there are environmental risks, and can address both environmental sustainability issues and public concerns.

Commented [D1]: There are also concerns expressed about impacts on the economic value of capture fisheries for wild fish (e.g. sablefish, halibut).

Fisheries and Oceans Canada's (DFO) mandate relates to the conservation of fish and fish habitat. This applies equally to fisheries as it does to decisions related to aquaculture. The starting point for any decisions made by DFO regarding human activities around waterbodies in Canada, including aquaculture, is founded on three key pieces of federal legislation: the *Fisheries Act*, the *Oceans Act* and the *Species at Risk Act*. Consequently, in executing the Department's fiduciary duty, the conservation of fish and fish habitat requires the conservation of biodiversity within the ecosystem, and the habitat and productivity of fish species. Given the complexity of detecting or monitoring biodiversity or productivity, proxies are used as practical measures for managing the environment. Therefore, the threshold for unacceptable harm to fish or fish habitat is any activity that has the potential to cause a population-level effect to fish species.

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Commented [D2]: Potential may need to be qualified further. Groups external to DFO often interpret this to be synonymous with possible. If this is how it continues to be framed it is extremely open ended i.e. although it's possible that pigs might fly, it's highly unlikely" which is the type of position we're often attempting to stake out. It would be more readily defensible to talk about activities that are likely versus unlikely to cause a population level effect to fish. This is clearly where the text intends to go in sections below that identify DFO's use of risk assessment and risk management as part of an integrated approach to ensuring capture and culture fisheries, ecosystems, habitats are managed to be sustainable.

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In addition, there are international commitments and best practices that are relevant to the management of activities. The Rio Declaration of the UN Conference on Environment and Development (UNCED) supports the right of sovereign states to pursue responsible economic development opportunities as long as other member states or future generations are not negatively impacted by such developments. The notion of the Precautionary Approach (PA) is geared towards large-scale threats, especially when the consequences are serious or irreversible (e.g., climate change).

Many governments apply the precautionary principle as part of an overall risk management framework to activities that may not potentially result in large-scale or permanent environmental impacts, but may be activities that have societal concern. It is within this context, that DFO applies precaution as required in delivering its regulatory and legislative responsibilities for aquaculture.

Commented [D3]: Again, the notion of permanent requires further definition. If one defines this in terms of human life-spans, a permanent change is one that lasts longer than the average generation time of our population (e.g. 80 years or less) but from an ecological or evolutionary perspective 80 years is a temporary condition.

¹ FAO - The State of World Fisheries and Aquaculture 2018

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The following risk management framework for aquaculture is consistent with the overarching Sustainable Fisheries Framework. It also builds on the 2008 Aquaculture Policy Framework (APF) and specific policies developed to support DFO's B.C. Aquaculture Regulatory Program (BCARP).

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Moreover, this Framework is not meant to create any new legal obligations to apply precaution. DFO's role in regulating the aquaculture sector is fundamentally linked to and is consistent with the overarching Sustainable Fisheries Framework. (SFF). The SFF provides the foundation for an ecosystem-based and precautionary approach to fisheries management in Canada, and provides the basis for ensuring Canadian fisheries are conducted in a manner which support conservation and sustainable use. Ultimately, through integration with the broader SFF, the residual effects of aquaculture on fish and fish habitat, following all mitigative actions, ensures that these effects can be taken into account in the sustainable management of fisheries.

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DFO'S Approach to Aquaculture Management

Aquaculture Management Objectives

The overarching departmental aquaculture management objective is to create the conditions for a successful and sustainable aquaculture industry across Canada. Within the overall objective, the department's goal for aquaculture is to ensure that fish and their habitats are protected using regulatory mitigation, monitoring and compliance approaches that are efficient, effective and aligned with the potential risk to the environment, and integrated (to the extent possible) with broader fisheries management approaches. Specifically, the **threshold for unacceptable harm to fish or fish habitat is any activity that has the potential to cause a population-level effect to fish species**. Recognizing that aquaculture is managed federally and by provincial and territorial governments, the department's overall assessment of risk will consider risk management and mitigation measures by all regulatory partners.

An Ecosystem and Precautionary Approach

Ecosystem approaches recognize that humans are part of, and have significant influences on, their environments. In aquaculture management under an ecosystem approach—as in fisheries management more broadly—regulatory decisions consider the impact of human activities on fish species, habitats, and the ecosystem of which these species are a part, and take into account broad ecosystem changes related to weather and climate. While it is recognized that all habitats, species, populations and communities play a role in aquatic ecosystems, some are more important from an ecological perspective and some are more resilient than others.²

DFO incorporates a precautionary approach within its ecosystem approach to fisheries management decision-making, supporting the economic use of resources while ensuring that

² *Principles of Ecosystem Based Fisheries Management*: <http://www.dfo-mpo.gc.ca/fm-gp/peches-fisheries/fish-ren-peche/sff-cpd/ecosys-back-fiche-eng.htm>.

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potential risks to aquatic environments are managed to prevent harm to fish populations and habitat, and to limit other less serious harm to the extent feasible given available technology and costs. Management decisions are more cautious when scientific information is uncertain, unreliable or less complete.³

Implementing an Ecosystem Approach in Aquaculture

An efficiently and effectively applied ecosystem approach for managing aquaculture in Canada includes risk management that considers environmental impacts holistically to enable the evaluation of ecosystem level impacts. This integrated strategy is supported through a risk management framework. The holistic evaluation of impacts is supported by the use of the Pathways of Effects (PoE) model for aquaculture (see next section).

Taken as a whole, this approach is designed to support the consistent regulatory management of related aquaculture activities while identifying location, species or operational-specific factors that may influence the extent of the impact on the environment in a particular situation.

Aquaculture Environmental Risk Management

There are five major elements in the Department's approach to managing the environmental risks that may arise due to aquaculture activities (Figure 1, below).

- (1) Defining the environmental and ecosystem objectives for aquaculture activities in Canada: these objectives are defined within legislation, through intergovernmental and international agreements, and consideration of societal values;
- (2) Issue identification: these can be identified through the results of scientific research, monitoring of environmental changes, and/or through public engagement;
- (3) Risk assessment: the science-based characterization of the likelihood and consequence of an activity and assessment of the overall risk, based on the current state of knowledge, and, the identification of uncertainty;
- (4) Risk management: this includes the assessment of how to address uncertainties through applying precaution measures and options for regulatory measures (mitigation and compliance/effects monitoring), and management decisions on mitigation, monitoring, and licencing; and,
- (5) Monitoring and evaluation of the activity against the identified risks.

Commented [D4]: As noted earlier, it would be advantageous to link items 3 and 4 here explicitly to statements about "potential to induce population level harm" above.

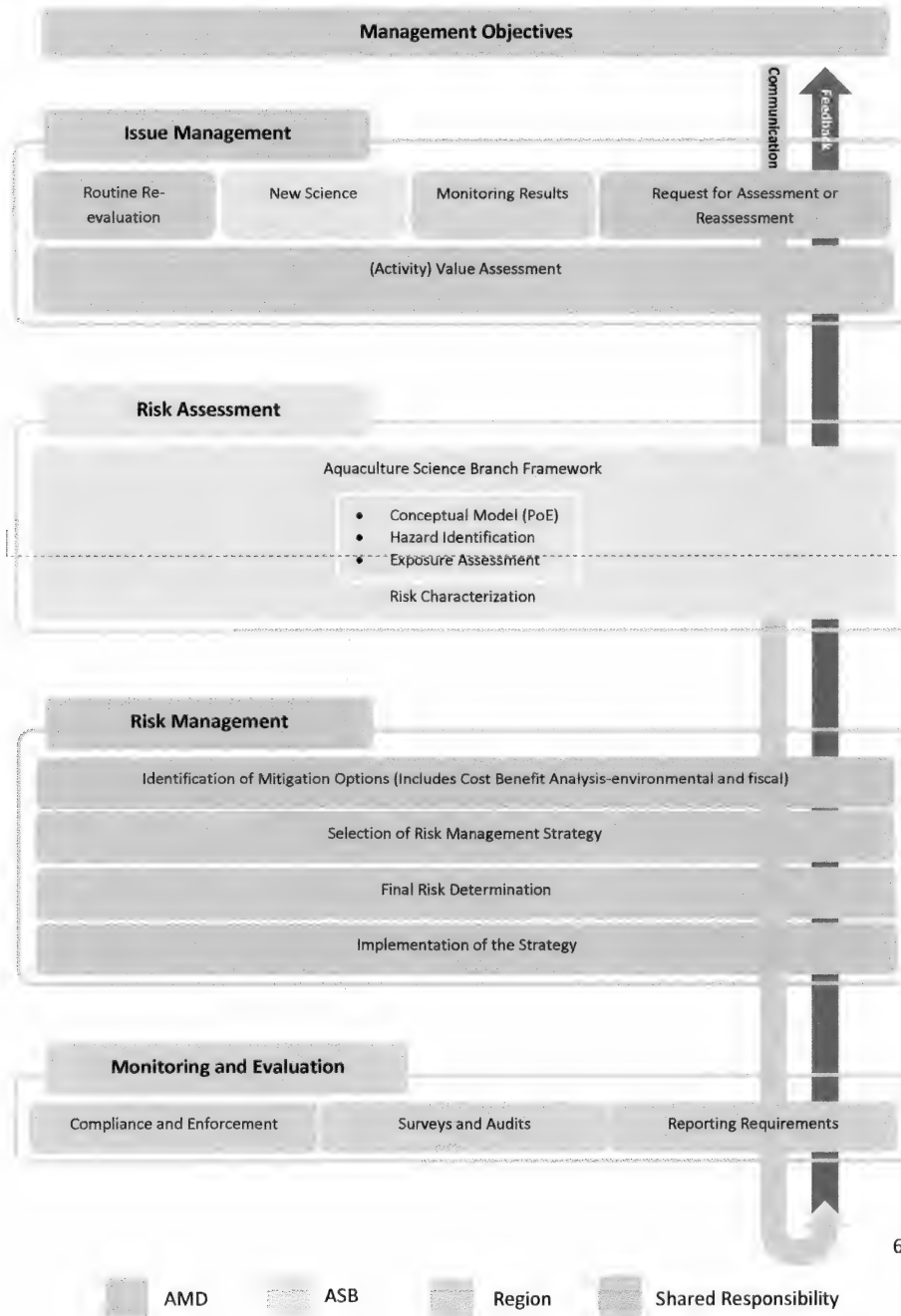
Throughout this process, communication and feedback are critical.

Integral to this process is that management decisions are based on many considerations, including, but not exclusively, scientific, social, economic and political. It is important to note that not all aquatic areas require equal levels of protection, as not all areas are equally ecologically or biologically significant or vulnerable.

³ A Fishery Decision-making Framework Incorporating the Precautionary Approach: <http://www.dfo-mpo.gc.ca/fm-gp/peches-fisheries/fish-ren-peche/sff-cpd/precaution-eng.htm>.

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Figure 1: Aquaculture Environmental Risk Management Framework



Commented [D5]: Formal risk assessments require assessment of exposure and impacts (outcomes). I don't see this included here unless it's implicit in the PoE element.

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Management decisions should also take it into consideration, as may be available, Indigenous Peoples traditional and ecological knowledge.

This approach supports management decision-making with respect to both (1) the setting of broad management (mitigation and monitoring) measures, such as siting criteria and general conditions on operations; and, (2) the consideration of individual applications (e.g., new or amended licences), focussing resources on risks that are unique to the proposed application.

Pathways of Effects (PoE) Model

A Pathways of Effects (PoE) model is a tool that can convey complex interactions between human activities, the stress they can place on the environment (pressures), and environmental effects. The model operates on the premise that human activities can place stress on the environment which, in turn, can lead to various environmental effects. The model recognizes that a single environmental stressor can have multiple source activities and can lead to one or more environmental effects. It also recognizes that a single environmental effect can be influenced by one or more stressors or activities.

PoE diagrams group similar components together at each level in the model (activities, stressors and effects), noting inter-linkages in text descriptions of the environmental considerations. These diagrams and descriptions are designed to communicate information in a manner that facilitates the consideration of overall impacts on the environment, and the ecological benefits and costs of various potential management measures, including interactions between measures and cumulative impacts.

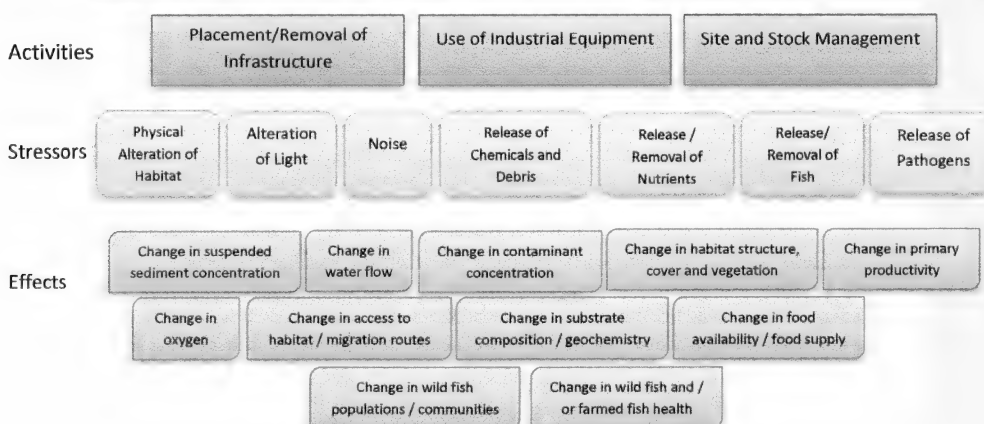
The scientific basis for links between aquaculture activities, stressors and effects was peer-reviewed through DFO's Canadian Science Advisory Secretariat process, and the summaries of the scientific state of knowledge for each of the stressors. This information is available for use in the evaluation of aquaculture activities and the identification of where management intervention may be required to protect fish and/or fish productivity/populations.

Commented [D6]: Weaker language than assessment. Intentional?

Commented [D7]: Has this been completed? Are the results published and generally available? If so, identify the link to reports.

Figure 2: Pathways of Effects for Finfish and Shellfish Aquaculture

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At the specific aquaculture application level, the linkages between each of the stressors and the relevant effects are considered. The specific environment and activity will determine which stressor-effect linkages exist, and what mitigation measures can be used to effectively and sustainably break the stressor-effect linkages.

- **Physical alterations to the habitat** occurs when activities related to placing or removing physical infrastructure (e.g. net pens, longlines, rafts, anchors and moorings, shellfish beach culture structures), as well as during the use of husbandry equipment (e.g. underwater lights to increase growth in marine finfish or acoustic deterrent devices to discourage predators⁴).

The extent and impact of the predicted physical alterations to habitat are considered primarily during the pre-operational stage (e.g. site application), which includes an evaluation of the type of benthic habitat in the area being proposed for aquaculture.

- **Release of chemicals and debris** occurs primarily with activities associated with site and stock management, and the use of operational equipment where chemicals and debris may be released. Examples include the use of pesticides, drugs and antifouling agents, and the use of materials in construction (e.g. steel, wood, floatation) and operations (e.g. feed bags, ropes), which can be lost from sites as debris.

The effect of the use of pesticides, drugs and antifoulants on the receiving environment, including on non-target organisms, is assessed by Health Canada.

- **Release of organic and related matter** occurs as a result of stock management activities (e.g. the feeding and cultivation of fish, removal or natural sloughing of biofouling organisms from physical infrastructure) that have an organic or related component (e.g. nutrients).

The predicted extent of organic deposition on the surrounding seafloor is assessed at the pre-operational stage. As part of the on-going operational compliance, marine finfish aquaculture operations must meet a performance-based regulatory requirement related to the release of organic matter.

- **Removal/release of nutrients and organic matter** occurs as a result of stock management activities where some cultured species (e.g. bivalves) remove particulate matter, nutrients and oxygen from the water column while others through excretion release nutrients into the water column.

The predicted extent of the removal and/or release of nutrients on food-webs and wild populations is assessed at the pre-operational stage.

- **Release or removal of fish** occurs primarily as a result of stock management activities.

Commented [D8]: Finfish and others will release non-trivial amounts of nitrogenous waste that impact pelagic and benthic food-webs.

Commented [D9]: Is this currently done or should it be added ?

⁴ Note that the use of acoustic deterrent devices is not a current practice in Canadian aquaculture.

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The removal of fish is considered and managed as bycatch. This occurs when some individual wild fish may be temporarily or permanently removed from waters along with cultured fish (e.g. during grading or at harvest), or as part of biofouling or predator control.

The addition of fish to the environment occurs either as a result of intentional stocking of cultured fish into aquatic environments for cultivation (e.g. salmon enhancement), or as a result of unintentional release of fish (e.g. escapes).

The impact on wild populations from the unintentional release of cultured organisms is considered at the pre-operational stage, and is also linked to fiduciary responsibilities associated with the *Species at Risk Act*.

- **Release of pathogens and pests** occurs associated with site and stock management. The increase in biomass of fish within an aquaculture site can influence the presence or abundance of fish pathogens (e.g. bacteria, viruses) and pests (e.g. sea lice and tunicates).

The introduction of pathogens or pests is evaluated at the operational stage, primarily by the Introductions and Transfers Committees (ITC). Conditions of licence outline mitigation measures for the management of the abundance of pathogens or pests. Additionally, notifiable diseases are regulated by the Canadian Food Inspection Agency.

Additional details on the characterization of each of the stressors, the current status of regulatory thresholds, and current management and mitigation practices are found in Annex 1. Also, a case study for the management of sea lice in B.C. is found in Annex 2.

Stakeholder and Indigenous Peoples' Engagement

Stakeholder and Indigenous peoples' engagement to support sound aquaculture governance is critical. The lack of social licence is a major barrier to robust aquaculture growth. Other factors, including the type of regulatory regime or site-specific development capacity characteristics, may play a role, but not to the extent of societal acceptance. The best mechanism for sustainable growth is via coastal zone and area-based management approaches which fully engage interested stakeholders and indigenous groups, who may actually contribute to decision-making. These processes not only support general agreement of where sites should go, but also the areas of greatest concern to focus on.

It should be recognized that some risks are new or emerging, and the evolution of scientific knowledge may influence society's tolerances and its chosen level of protection. An understanding of the "public's tolerance for risks" or "society's chosen level of protection" underpins the need for high transparency, clear accountability, and meaningful public involvement and communication.

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Two-way sharing of information and the inclusion of a range of perspectives in the decision-making process can become the cornerstone of openness and transparency, and enhance credibility of and trust in the decisions that the Government develops.

Conclusion

DFO has managed aquaculture over the years based on managing environmental impacts and the potential risks these can pose to fish habitat and fish populations, as identified through the DFO peer-reviewed science process. Where relevant, DFO regulators strive to develop management standards or thresholds, which are informed by science, based on best practices globally, and have received some form of stakeholder and indigenous peoples' input.

Aquaculture management is a shared responsibility between the federal and provincial governments; thus, management frameworks need to be foundationally the same. In circumstances where there is a potential for unacceptable harm to fish (population-level effects), it may be appropriate to make decisions and implement precautionary measures in the near term, without having full certainty of the probability or magnitude of harm. Close monitoring would also occur to assess the effectiveness of the measures in addressing risk and overall impacts. Follow-up activities, including research and monitoring, are key to reducing scientific uncertainty and allow improved decisions to be made in the future. Finally, stakeholder and Indigenous peoples' engagement throughout the risk management process is critical, not just at the final decision-making process.

Commented [D10]: Do we or should we have anything to say here about the use of results from other peer reviewed science processes from the broader national and international communities of science i.e. are we attempting to be truly inclusive?

Commented [D11]: It's not clear what the jargon "foundationally the same" means, e.g. commonly supported by both?

Commented [D12]: Here too there's a need to be clear i.e. population level effects are possible (?), likely (?), or observed? Sounds like potential but this comes back to the fundamental point of the difference between "any potential" as opposed to applying levels of likelihood defined by risk assessment work in relation to potential. Leaving this open will not promote transparency in communications with those who oppose these types of activities.

Commented [D13]: Research and monitoring have been focused almost entirely on near-field effects while ignoring more subtle and difficult to identify far-field effects. For example, current monitoring to identify near-field versus far-field population level, impacts on wild salmon is largely non-existent. We could do better through standardized monitoring for impacts on a spatial continuum from near to far field locations of specific salmon populations (i.e. parasite and pathogen burdens on smolts out, adults back for a "representative set of populations for which we explicitly assess productivity variations) but have yet to initiate this. Consequently, the evidence we need to defend our approach to aquaculture management to minimize impacts on wild salmon populations remains relatively weak.

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Annex 1: Details on Aquaculture Stressors, Effects and Risk Management

STRESSOR	THRESHOLD	MANAGEMENT ACTION / MITIGATION
<p>Release of pests and pathogens</p> <p>Pathogens can be endemic in wild fish populations (i.e., occur naturally in wild populations in a region) or exotic (i.e. occur naturally in other locations and have been introduced in a region). The presence of endemic pathogens can be amplified under some circumstances where fish are in close proximity (e.g. spawning grounds, schooling and aquaculture). Endemic pathogens tend to have a less severe effect on native populations than exotic (or introduced, non-endemic) pathogens, as over multiple generations native species have typically developed an immune response to endemic pathogens.</p> <p>The health status of wild fish often cannot be directly assessed, and changes in wild fish populations or communities due to disease are difficult to determine. Diseased and moribund fish are quickly removed from the population through processes such as predation or mortality; sampling can therefore be easily biased toward healthy individuals. The presence or absence of pathogens is particularly difficult to determine in wild fish populations, nor is there available scientific data to determine the effect of low level presence of pathogens at the individual or population level.</p>	<ul style="list-style-type: none"> Sea lice threshold (B.C. only); Mandatory Reporting of Fish Health Events (i.e., treatment or % loss) (B.C. only) 	<p>Conditions of licence require treatment for sea lice above threshold (3 lice/fish in B.C.)</p> <p>Monitoring fish health is a particularly important mitigation tool when cultured fish are destined for movement to another location or for release into aquatic environments. The determination of the appropriateness of planned movements or releases of fish must be based upon a review of the disease and mortality history of the cohort, on recommendations by a qualified fish health professional, on the results of any recommended pre-release disease screening, and on guidance from regulatory agencies.</p>
<p>Release (or removal) of organic matter and nutrients</p> <p>Potential sources of the release of other organic matter include fish carcasses (e.g. from cultured fish or bycatch⁵), feed spillage, faeces,</p>	<ul style="list-style-type: none"> BOD threshold 	<p>Footprint addressed through initial siting decisions (benthic impact depositional modeling)</p> <p>Performance based threshold (on-going assessment once/production cycle) – under the AAR, sites cannot be restocked</p>

⁵ The release of incidental finfish catch during finfish harvest, as may be required under conditions of licence, may contribute to organic matter in the environment if the fish are dead or have a low chance of survival.

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<p>harvest waste or offal, including blood. Release of organic matter into the marine environment from humans working and/or living on site could also constitute a minor contribution of organic matter to aquatic environments, should it occur. Human waste is generated on boats or in working or living accommodations as part of daily activities like cooking, bathing and bodily functions. The majority of organic matter introduced into the environment from finfish aquaculture will be associated with excess feed and faeces. Accumulation of the organic matter can result in a change in the benthic biodiversity around a site.</p>		<p>if sulphide threshold exceeded</p>
<p>Release of chemicals/drugs</p> <p>Pesticides are assessed by the Pest Management Regulatory Agency of Health Canada for value of use, human, animal and environmental risks under the <i>Pest Control Products Act</i>. Factors considered in environmental risk assessments related to pesticides include the potential transport and dispersal of products and/or their constituents following release into waters, as well as the exposure of non-target organisms to concentrations of substances that could result in lethal or sub-lethal (e.g. behavioural, reproductive) effects. The severity of impacts on exposed non-target species will depend on factors such as the toxicity of the product used, the dosage, the presence of susceptible non-target species / life stages of species, and environmental conditions.</p>	<ul style="list-style-type: none"> No thresholds – Research and analysis underway to provide advice on the design of a post-deposit monitoring program. 	<p>PRMA can place limits on the timing, location and volume of the release of specific materials.</p> <p>Under development – traffic light system for 1) pre-siting assessment to inform site placement, and 2) cumulative impacts [informed by post deposit monitoring program (site level) and aquaculture monitoring program (bay scale)]</p>
<p>Physical alteration of habitat</p> <p>The addition, removal, and</p>	<ul style="list-style-type: none"> Maximum shellfish aquaculture coverage of 7% per bay in some areas of Canada 	<p>Primarily addressed through initial siting considerations.</p> <p>In situations where wild fish may be</p>

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<p>modification of physical structures may affect bottom sediments, benthic communities, pelagic communities, and hydrodynamics.</p>		<p>present only on a seasonal basis, or where habitat is used by a species during a particular period (e.g. during reproductive phases), measures to limit the duration, timing or extent of installation, harvest or site maintenance activities may be warranted.</p>
<p>Release (or removal) of fish</p> <p>Farmed finfish, including salmon, may escape, usually due to equipment failure or human error. Equipment failure may be weather-related, caused by predator attacks or other events that stress the containment infrastructure. For there to be genetic intrusion, establishment of non-native populations, predation or competition, farmed fish must first be released into the wild through escape or the release of viable gametes.</p>	<ul style="list-style-type: none"> • Reporting of escapes may be required, depending on jurisdiction • No <i>direct</i> genetic impact risk on West Coast from Atlantic salmon farms 	<p>Addressed through conditions of licence and development of national containment standards (to be developed)</p> <p>Regulation of fish containment structures and use of triploid farmed fish would further lower the extent of direct genetic interaction.</p> <p>In the event that an unintentional release does occur, measures such as escape response plans may help to recover released fish., particularly where a significant risk of harmful interaction with wild populations has been identified.</p> <p>Escape reporting and analysis of the measures employed may be used to help assess the effectiveness of current mitigation measures and develop future facility or regulatory measures, as appropriate. Measures for recording and reporting cultured fish inventories as well as accurate records of introductions and transfers of licensed species support a broader understanding of the scope (estimated quantity, species and timing) of unintentional releases, and may form part of the management approach in mitigating their effects.</p> <p>In circumstances where a new species is being considered for rearing in an area for the first time, a specific environmental risk assessment is warranted to determine whether or not an Introductions and Transfers licence should be issued (see National Code on Introductions and Transfers LINK). The Code provides guidance that the I&T risk assessment should typically focus on incremental risk aspects that are particular to that species. Species identified as higher risk may have special regulatory conditions imposed on</p>

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		<p>them to bring the risk to an acceptable level. Where risk outcome warrants, some species may not be authorized for culture. An I&T risk assessment may also be warranted where a species is native to the province but new to culture. In terms of risks related to release of fish, the assessment should start by focussing on the probability of the cultured gametes interacting with wild fish populations, and in the case of finfish, the potential for escaped fish to interact and compete with populations of the same or other species.</p>
<p>Noise</p> <p>Noise associated with aquaculture operations may be produced incidentally during the routine operation of equipment such as aerators, feeders, generators and power washers, and by vessels servicing aquaculture facilities. The effects of such noise are expected to be localized, short-term and likely insufficient to cause injury or permanent displacement to marine organisms.</p>	None	<p>Addressed through initial siting considerations and conditions of licence</p>
<p>Alteration in light</p> <p>Measurements of light penetration around net pens show that little visible light is found outside the pens, which suggests that the use of lights in aquaculture will have minimal and mainly local ecological effects.</p>	None	<p>Addressed through initial siting considerations and conditions of licence</p> <p><i>In B.C. is there still a requirement to report the use of lights?</i></p>

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Annex 2: A Case Study- Management of Sea Lice in B.C.

1. Description of Stressor and Potential Impact – Sea Lice

Environmental

The release of pathogens or viruses from aquaculture facilities through site and stock management is a stressor described in the Canadian Science Advisory Secretariat (CSAS) research document “Pathways of Effects for Finfish and Shellfish Aquaculture” (PoE). The primary effect associated with this stressor, as described in the PoE, is a change in wild fish and/or farmed fish health. Additional sea lice specific science advice has also been provided, and this case study and analysis draws on this advice⁶.

Sea lice are endemic to the Pacific Coast and are found on several species of Pacific salmon and non-salmonid species. They are also present in other areas of the world where Atlantic salmon reside, such as Norway and Scotland. There are a number of sea lice species throughout the world that have a range of hosts and life cycle characteristics. The species of concern in B.C. from an aquaculture perspective is the *Lepeophtheirus salmonis* (Salmon louse); however, there is another species, *Caligus clemensi* (Herring louse) which can occasionally cause concern in aquaculture facilities. The sea lice life cycle includes numerous stages, such as: the free-floating Nauplius stage, infectious copepodid stage, attached chalimus stages, and finally the motile stages (pre-adults, adults).

Farmed Atlantic and Pacific salmon are stocked at the marine sites free of lice and infection occurs by exposure to passing adult wild salmon. This is known as “spillover.” The intensity of infestation on farmed salmon is based on a number of factors including the size of the wild salmon run, sea water temperature, salinity and the health of the farmed fish. Cultured Pacific salmon are less susceptible to sea lice infestation than Atlantic salmon. When infestation occurs at a farm the sea lice numbers may become internally amplified, which may result in “spillback” to wild salmon. Of particular concern is the effect this may have on juvenile salmon smolts which have recently entered the marine environment as they are most susceptible to sea lice. Wild salmon smolts out-migrate from their natal streams during the spring and early summer. A corresponding “out-migration window” with different requirements for management of lice levels is incorporated into the licence conditions. The out-migration window as currently defined runs from March 1st until June 30th annually.

Social

There is a high level of concern from a segment of the public, some First Nations and ENGOs, on

⁶ Assessment of Sea Lice Monitoring and Non-Chemical Measures, DFO 2014 SAR 2014/006

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the impact aquaculture has on wild Pacific salmon, and more specifically belief that sea lice can significantly negatively impact wild salmon populations. Wild salmon populations can be highly variable and in some cases a low run in one year can be followed by record high numbers; this happens in areas both with and without aquaculture facilities on migratory routes. Conflicting opinion about the possible impact of high levels of sea lice has not given these groups, governments, the media or the Canadian public a level of comfort that the Department is properly managing the risk the aquaculture industry may pose to wild salmon.

Commented [D14]: This is in part due to the fact that monitoring of wild salmon population variations in near-field and far-field locations along with assessment variations in the seasonal to annual sea-lice reservoir created by aquaculture facilities has not been designed or implemented to yield results that are more precise in pinpointing causes of salmon population level variations than these circumstantial assertions that variations occur due to all sorts of factors.

2. Current Management and Mitigation – Sea Lice

The goal of the current management approach is to ensure that no disease or disease agent negatively impacts the protection and conservation of fish. Presently, risk related to sea lice is managed through licence conditions and the Fish Health auditing program.

Pre-Operational Management Approach

The Precautionary Approach is applied during the consideration of new sites, both from a site-specific and broader area perspective. This is also true for applications for increased production at an existing site. There is recognition of the potential risk of increased sea lice abundance and corresponding infection of out-migrating salmon from licenced facilities as a result of increased production. Assessments including the history of sea lice abundance levels at that farm and neighbouring farms in the general area include recommendations for mitigation measures, such as area-based management (e.g. coordinated and timing of stocking, fallowing and sea lice treatments), maintenance of single-year classes, practicing integrated pest management, and timing of stocking to reduce the need for sea lice treatments. Geographic elements considered during the assessment include hydro-connectivity between the proposed site and adjacent farms, and proximity to known salmon migration routes.

When siting new facilities, efforts are made to avoid the siting of new aquaculture facilities in areas which are known to be important wild fish migration routes, nurseries, sensitive habitats, or have other importance to wild fish populations or significant to First Nations. Ongoing science and research forms part of this consideration.

Commented [D15]: There are virtually no areas along the BC coast where risks to one or more salmon populations of importance to First Nations or others will be low or absent by definition.

Current Operational Management Approach

The licence conditions include sea lice monitoring protocols as well as sea lice abundance thresholds that a licence holder cultivating Atlantic salmon must abide by. This threshold is set at an average of three motile (pre-adult and adult) lice (*Lepeophtheirus salmonis*) per fish. During the outmigration period, salmon farmers are required to maintain lice levels below the three motile lice threshold. Outside this period, they are not obligated to maintain this threshold, but must notify DFO when they exceed and develop a mitigation strategy for consideration by DFO officials. This system allows for lice control during the sensitive out-

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migration period, but does not require treatment outside this period, thereby reducing the use and potential development of resistance to various sea lice therapeutants. Sea lice sampling on farms is required every two weeks at minimum during the out-migration period, and DFO auditing of the reported numbers and sampling methodology occurs on 50% of all active farms during this time. For the remainder of the year, sampling by industry is only required once per month, but will increase to every two weeks if threshold levels are exceeded.

Commented [D16]: Defined on what basis and in which locations?

Mitigation

Companies are increasingly moving towards an area-based management approach where all smolts in a given area are the same year-class and, if treatments are required, they are coordinated between these sites. Treatments are ideally timed in coordination with returning adult wild fish so that all wild fish have left the area before treatment is initiated. This is to avoid reinfection and retreatment which can lead to resistance. Currently the primary sea lice treatment is the use of emamectin benzoate (SLICE), which is an in-feed parasiticide.

Commented [D17]: Same comment as immediately above.

In some areas in B.C., SLICE resistance has emerged in recent years. Industry is rapidly developing alternative treatment modalities to curtail SLICE resistance, and prevent the development of wide-spread resistance in the sea lice population in B.C. This involves the rotational use of alternative treatment methods, such as novel in-feed parasiticides, hydrogen peroxide baths and/or mechanical sea lice removal (e.g. Hydrolicer). An alternate method of reducing absolute sea lice inventory is through harvesting, which typically would occur when fish are near harvest weight. This method is only effective if harvesting is done at a rate that reduces a farm's absolute sea lice inventory (as defined in the licence).

3. Scientific Certainty – Sea Lice

A large number of scientific studies have been conducted in recent years which have tried to determine what, if any, harm is posed to wild salmon by sea lice spillback from Atlantic salmon farms. No conclusive evidence has been found to suggest that sea lice originating from farms are causing harm to wild stocks on a wide scale. This has largely been accepted by stakeholders and opponents to the salmon farming industry. This indicates that the three motile threshold is sufficiently conservative to mitigate risk to wild salmon posed by sea lice originating from farms. In the rare instances where farms have not been able to control lice levels during the out-migration period (often as a result of SLICE resistance), lice levels are found to be higher on out-migrating salmon smolts. This indicates that lice management on farms is vitally important to prevent an undue lice burden on wild smolts.

Commented [D18]: This observation if supported with sufficient data would suggest that all parasites/pathogens will generate similar concerns. However if we adhere to the position that population level harm is likely to be associated with frequency of occurrence on either juvenile or adult fish without any demonstration of associated changes in productivity we may be subjecting aquaculture development to greater precaution than necessary. The alternative is to design a standardized monitoring program on wild salmon populations that provide contrast in spatial proximity to aquaculture facilities to determine whether PoE models that suggest risk(s) from parasites and pathogens varies inversely with distance are reliable. The cost of this type of monitoring would likely be less in the moderate to long term than our current practice of dealing with each parasite and pathogen as a special case.

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4. Residual Risk and Application of the Precautionary Approach – Sea Lice

Environmental

A changing climate makes future lice mitigation more uncertain and challenging. In years with warmer water temperatures and increased salinity the management of lice becomes more difficult. This is likely to become more common as time progresses. Additionally, the emergence of SLICE resistance on B.C.'s coast has presented a significant challenge to industry for effective lice management. The adoption of additional treatment options by industry is very welcome and has demonstrated that lice levels should be able to be effectively controlled, despite a changing climate and without sole reliance on SLICE. Effective management is vital to ensure that wide-spread resistance to lice therapeutants does not occur as it has in other jurisdictions. Ongoing research into the genetic determinants of lice resistance, use of cleaner fish, alternative treatments and alternative cage designs/husbandry methods are all very promising, and should be encouraged and supported to allow proactive management by industry. Under the present management regime, the residual risk once operational is determined to be medium. Application of the Precautionary Approach requires that the Department utilize existing and potential new management measures to ensure that the risk stays within an acceptable range.

Commented [D19]: All the more reason to consider the type of monitoring and evaluation of potential spatial and temporal variations in impacts on wild salmon populations noted above.

Context	Risk Attributes		
	High	Moderate	Low
	High		
	Moderate	X	

Social

Based on the level of scientific certainty that sea lice are not causing harm to wild fish populations the level of concern raised by the public is expected to diminish over time. Due to the variable nature of salmon returns there may continue to be a perception that declines in salmon populations are related to sea lice impacts. As noted above, environmental residual risk exists based on changing climate conditions. It is incumbent on DFO to ensure a robust scientific program remains in place to better understand how the change in climate conditions is affecting sea lice, and their interaction with farmed and wild fish. If this scientific research along with changing management requirements (as necessary) is communicated to the public in a pro-active manner, social acceptance should increase.

Commented [D20]: Same comment as immediately above.

SEPTEMBER 18, 2018 DRAFT

Context	Risk Attributes		
		High	Moderate
	High		
	Moderate		X

5. Next Steps and Future Developments – Sea Lice

DFO conditions of licence relating to lice have been found to be vague, outdated and sometimes unenforceable. Some preliminary ideas on changes to the licence to allow better regulation, while also providing additional tools and guidance to industry, include:

- Consider moving to adult female-based threshold, rather than current motile threshold.
- Establishment of a farm-based, in addition to a fish-based (as currently used), sea lice threshold (For example, we assume 500 000 fish on farm, with three motiles = 1.5 million lice allowable on a single farm).
- Harvest would no longer be deemed an appropriate management action within the out-migration [would only be used to lower farm-based “absolute sea lice inventory” below farm-level threshold (as mentioned above) before entry into out-migration].
- Change licence condition of “active farm” away from number of pens stocked (more than 3), to absolute number of fish on site for a given time (e.g. active site could be defined as: more than 30 days have passed since the introduction of more than 50 000 fish to a sea site).
- Consideration be given to initiating mandatory sea lice reduction prior to March 1, which is the generic time when out-migration is recognized to start, as stated in licence conditions.
- Implement mandatory post in-feed lice treatment reporting to better monitor efficacy.
 - E.g. 25-30 days have passed since the completion of treatment with an in-feed parasiticide medication.
- Implement prohibition on use of lice chemical therapeutant for a time in response to resistance.
 - E.g. treatment failure could be defined as: “failure to achieve > 60% reduction in pre-treatment lice numbers at the 25-30 day post-treatment counts”.
- SLICE use would be prohibited at that site again during the calendar year.

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Moving forward the Department must continue to do scientific research on sea lice and its relationship to farmed and wild salmonids in order to develop a clearer understanding of the possible linkages between the two and the corresponding risk to cultured and wild fish. It should also be cognizant of, review related independent science (science which comes from sources outside of DFO), and react to key new findings by adjusting our research objectives. Operationally DFO must adapt to new science, making changes to present management approaches as necessary.

Although the risk posed by sea lice is considered low based on our present scientific understanding, a Precautionary Approach to the siting of new farms in the future could incorporate the potential of sea lice becoming a higher risk because of changing environmental conditions.

Over and above the current operational management approach it is recommended that a risk-based traffic light system be implemented that would be tied to some objective measure of sea lice abundance (e.g. number and severity of exceedances). This approach could amalgamate information from an individual farm or a number in a geographic area that have hydro-connectivity. It is well established that sites which have good overall fish health performance, including a low sea lice burden, are less likely to become susceptible to disease.

A green designation would indicate that historically a site has good sea lice management with rare incidences of threshold exceedance and low or negligible mortality indicating a low residual risk to wild salmon. The Department could consider increases in production at these sites. A yellow designation would indicate some recurrent sea lice threshold exceedances that are able to be managed on site without the risk of associated fish health issues and do not represent a notable threat to wild salmon. Increases in production would not be considered and additional management measures may be required. A red designation would indicate serious, significant or repeated sea lice exceedances that could potentially represent a notable threat to wild salmon. Drastic management measures could include reducing authorized production, a requirement to fallow for a significant time period, or cancellation of the licence.

At present there is a lack of flexibility in the licence conditions to require actions such as those outlined for farms designated red as the Department does not have the legislative authority. Moving forward the Department should pursue legislative/regulatory changes to obtain this authority.

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APPENDIX I: Marine Finfish Pre-Operational Risk Table

There are a number of elements that are already assessed at the pre-operational application stage and the risks are summarized for senior management in a table.

Farm name:	Company:			
Elements Assessed – Wild Fish and Fish Habitat	Low	Med	High	N/A
Presence/use and interactions with CRA fishery or rare species				
Presence of important fish habitat (e.g. sponge reefs, rockfish nursery, etc.)				
Presence/use and interactions with SARA listed species				
Appropriate distance to salmonid-bearing streams				
Appropriate distance to important herring spawn areas				
Appropriate distance to shellfish beds				
Appropriate depth, currents and benthic substrate				
DEPOMOD predictions acceptable				
Existing seabed conditions (e.g. capable of assimilating waste)				
Historic benthic monitoring results				
Use of lights				
Marine mammal usage & mitigation				
Elements Assessed – Fish Health	Low	Med	High	N/A
Diseases of concern on farm, nearby farms, and in area (if known)				
History of appropriate disease management on farm and nearby farms				
Prudent history of medicant use (if known)				
Hydrological connectivity with other farms & co-management plan(s)				
History of compliance and reporting on FH and SL				
Adequacy of submitted FHM, SOPs and Carcass Management Plans				
Water quality (e.g. DO, water flow; if known) & mitigation				
Natural challenges (e.g. plankton issues, harmful algal blooms; if known) & mitigation				
Fish density appropriate to maintain good FH (if known)				
Species intended to be grown is appropriate for the area				
History of predator stress & mitigation (if known)				
Elements Assessed – Sea Lice	Low	Med	High	N/A
Natural occurrence of sea lice at site				
History of staying below sea lice thresholds during smolt out-migration				
Appropriate use of available tools to manage sea lice in future				
Elements Assessed – Existing Fisheries	Low	Med	High	N/A
CSSP closure on bivalve shellfish beds used in CRA fisheries				
First Nations FSC fisheries/site access				
Commercial fisheries (direct or indirect displacement – reduction in stock				
Recreational fisheries (direct or indirect displacement – reduction in stock				
EFA/test fishery/research area				
Geoduck beds				

Jones, Simon

From: Lowe, Carmel
Sent: Wednesday, September 26, 2018 5:02 PM
To: Jones, Simon
Cc: Higgins, Mark
Subject: RE: URGENT INFORMAL: Sea Lice

Follow Up Flag: Follow up
Flag Status: Completed

Categories: Yellow Category

Thanks Simon.... Appreciated.

Carmel

Carmel Lowe, Ph.D.
Regional Director Science | Directrice régionale des sciences
Fisheries and Oceans Canada | Pêches et Océans Canada
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Government of Canada | Gouvernement du Canada

From: Jones, Simon
Sent: September 26, 2018 4:17 PM
To: Lowe, Carmel <Carmel.Lowe@dfo-mpo.gc.ca>
Cc: Higgins, Mark <Mark.Higgins@dfo-mpo.gc.ca>
Subject: RE: URGENT INFORMAL: Sea Lice

Carmel, Mark,

I have reorganized the material to bring the more relevant points to the fore:

Related to the Ha-Shilth-Sa article:

- DFO's sea lice regulations focus only on Leps and include a management threshold of 3 lice per fish.
- Prior to closure of the site there was an infestation with another sea lice species, "Caligus".
- The Caligus infestation was sufficiently severe to cause a fish welfare concern and trigger a SLICE treatment.
- Although the SLICE treatment was successful, the farm was closed [REDACTED]
- Persistent, high levels of Caligus are rare on farmed fish; as are welfare concerns caused by this parasite.
- Caligus is a common parasite of herring and stickleback in coastal BC.

Here are DFO's most recent approved media lines relating to sea lice/salmon farming in Clayoquot.

Media lines:

- Fisheries and Oceans Canada (DFO) is confident in the monitoring being done in the Clayoquot area by environmental non-government groups, and third party environmental consultants hired by Cermaq. For this reason, DFO determined that resources could be better directed to furthering research into SLICE resistance (SLICE is approved for use in Canada as an in-feed therapeutic used by the salmon aquaculture industry to manage sea lice. It can only be administered to farmed fish under veterinary prescription).
- DFO is keeping a close eye on the issue of SLICE resistance. The Department collected sea lice from Cermaq Canada's Bawden site in the Clayoquot area and sent them to the BC Centre for Aquatic Health Sciences for analysis, which confirmed SLICE resistance. Those lice were later sent to researchers at the Atlantic Veterinary College who are undertaking work to better understand the genetic basis for SLICE resistance.
- During most years, more than 90% of sites in BC are below the regulatory thresholds for sea lice during the wild salmon outmigration period (from March 1 to June 30 of each year). However, there were documented failures of SLICE treatment at Klemtu in 2015 and Esperanza Inlet in 2017 and now Clayoquot Sound in 2018.
- Research is under way, by DFO, industry, and academia, to find alternative methods to manage sea lice, and to better predict and track SLICE resistance. For instance, DFO is currently studying, or supporting research on, the use of Pacific perch as "cleaner fish" that eat sea lice off farmed fish and warm water baths to kill sea lice. More information on these projects can be found at www.dfo-mpo.gc.ca/aquaculture/sci-res/rd-eng.htm
- DFO is also supporting the licensing and approval process for alternative sea lice treatments, which are a necessary part of an integrated pest management approach.

Please let me know if these require refinement.

Simon

From: Lowe, Carmel
Sent: September-26-18 2:29 PM
To: Higgins, Mark; Jones, Simon
Subject: Fw: URGENT INFORMAL: Sea Lice

See request below.....

Simon - can you develop some bullets to feed into this?

Carmel

Sent from my BlackBerry 10 smartphone on the Rogers network.

From: Kaba, Kyle <Kyle.Kaba@dfo-mpo.gc.ca>
Sent: Wednesday, September 26, 2018 14:17
To: Thomson, Andrew; Lowe, Carmel
Subject: FW: URGENT INFORMAL: Sea Lice

Hi Andy/Carmel – We've received an urgent request from MINO on information (that could be shared with the Province) concerning the article linked below. Article is regarding high sea lice counts leading to Cermaq closing farm sites in Clayoquot Sound.

Can you please have a look and provide a few bullets that can be shared with MINO (for sharing with the Province). MINO has requested info as soon as possible. Would it be possible to have something by tomorrow at noon PST? Please let me know.

Thanks in advance and sorry for the short turn around.

Kyle

From: Butcher, Ashley
Sent: September-26-18 1:42 PM
To: Kaba, Kyle
Cc: Jarjour, Jasmine; Hirani, Samia; Khwaja, Saba; Kahn, Zoe; Barker, Tyler; Villeneuve, Anne-Marie
Subject: Re: URGENT INFORMAL: Sea Lice

Hey Kyle - over to you!

From: Richter, Julie
Sent: Wednesday, September 26, 2018 4:32 PM
To: Butcher, Ashley; White, Andrea
Cc: Jarjour, Jasmine; Hirani, Samia; Khwaja, Saba; Kahn, Zoe; Barker, Tyler; Villeneuve, Anne-Marie
Subject: RE: URGENT INFORMAL: Sea Lice

Hi Ashley – Pacific Region would be best placed to respond.
Julie

From: Butcher, Ashley
Sent: September-26-18 4:22 PM
To: White, Andrea; Richter, Julie; Villeneuve, Anne-Marie
Cc: Jarjour, Jasmine; Hirani, Samia; Khwaja, Saba; Kahn, Zoe; Barker, Tyler
Subject: URGENT INFORMAL: Sea Lice

Hey there - not sure who to direct this to. MINO urgently looking for information that could be shared with the province concerning the attached:

<https://hashilthsa.com/news/2018-09-17/high-sea-lice-counts-leads-cermaq-close-farm-site-clayoquot-sound>

Thanks,

Ashley

Delaney, Paula

From: Waddington, Zac
Sent: September-27-18 11:11 AM
To: Webb, Allison; Paylor, Adrienne
Subject: FW: Fish-level audit paper
Attachments: Audit paper Aquaculture Sept 26 edited proofs.pdf

Here is the “endemics” paper that Ian contributed to.

FYI

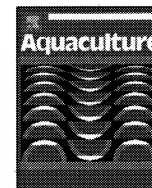
Zac

From: Ian Gardner [<mailto:iagardner@upei.ca>]
Sent: September-26-18 1:16 PM
To: Keith, Ian
Cc: Johnson, Stewart; Waddington, Zac; Jones, Simon; Garver, Kyle
Subject: Fish-level audit paper

Hi Ian,

Emilie and I edited the proofs including removing reference to detection of emerging diseases (as per the attached). We added a note on the first page that Kristi and Hugh are the contacts for molecular and histopath data, respectively, as they refused to make the entire dataset available with the paper. I still think the latter path should be pursued for completely transparency. We are confident that the data analysis part can withstand external scrutiny.

Thanks for helping to bring the project to completion,
Ian G



Histopathological and novel high-throughput molecular monitoring data from farmed salmon (*Salmo salar* and *Oncorhynchus* spp.) in British Columbia, Canada, from 2011–2013[☆]

Emilie Laurin^a, Diana Jaramillo^a, Raphaël Vanderstichel^a, Hugh Ferguson^b, Karia H. Kaukinen^c, Angela D. Schulze^c, Ian R. Keith^d, Ian A. Gardner^{a,b,*}, Kristina M. Miller^{c,e}

^a University of Prince Edward Island, 550 University Avenue, Charlottetown, Prince Edward Island C1A 4P3, Canada

^b Marine Medicine Programme, Pathobiology, School of Veterinary Medicine, St George's University, Grenada

^c Pacific Biological Station, Fisheries and Oceans Canada, Nanaimo, British Columbia, V9K 6N7, Canada

^d Aquaculture Management Division, Aquaculture Environmental Operations – Fish Health, Fisheries and Oceans Canada, Courtenay, British Columbia, V9N 2M2, Canada

^e Forest and Conservation Sciences, University of British Columbia, Vancouver, British Columbia V6T 1Z4, Canada

ARTICLE INFO

Keywords:

Aquaculture
Atlantic salmon
Pacific salmon
Histopathology
qPCR

ABSTRACT

The purpose of the study was to describe spatial and time-at-sea patterns of endemic and new infectious agents and histopathologically-identified lesions in dead-and-dying farmed non-native Atlantic (AS) and native Pacific (PS) salmon in BC, between 2011 and 2013. Novel high-throughput molecular testing and blinded histopathological examination of tissues were used to evaluate these patterns in fish-level analyses. Twenty-five of 45 infectious agents were detected, and 87% of 897 total fish tested had mixed detections, with up to nine agents in a single fish, and a higher agent diversity in PS than AS. Most frequently detected agents were the parasite *Desmozoön lepeophtherii* (*D.lep*) in farmed AS (88%), and the bacterium *Candidatus Branchiomonas cysticola* (*Ca.B.cys*) in farmed PS (89%). Overall, 92% of AS and 88% of PS had some histopathological change, mostly of mild to moderate severity, with renal interstitial hyperplasia as the most frequent change (AS: 33%; PS: 48%). Spatial patterns were statistically significant for five agents in PS versus the same agents in AS for Fish Health Zones in southwest Vancouver Island, Sunshine Coast, and Discovery Islands. Statistically significant time-at-sea patterns were detected for three agents each in AS (piscine reovirus, *Piscirickettsia salmonis*, and *D.lep*) and PS (*Ca.B.cys*, *Renibacterium salmoninarum*, and *D.lep*). Importantly, infectious salmon anemia virus, salmonid herpesvirus, salmon alphavirus, and infectious pancreatic necrosis virus were not detected. Furthermore, while the agents associated with proliferative gill disease (*D.lep*, *Ca.B.cys*, and gill chlamydia) were all detected, few fish showed evidence of lesions associated with this multifactorial disease. The majority of agents detected on BC salmon farms were known to be endemic, but new findings include the marine detections of some infectious agents reported to only cause freshwater or hatchery-based diseases (*Flavobacterium psychrophilum* and *Ichthyophthirius multifiliis*). The results of this descriptive study provide the proportion of positive test results in sampled dead-and-dying farmed AS and PS, as well as spatial and time-at-sea information on both agent and lesion detection, targeting areas of interest and concern to researchers, regulators, and aquaculture industry veterinarians for future population-based analyses.

1. Introduction

British Columbia (BC), on the Pacific coast of Canada, is the fourth

largest salmon farming region in the world, producing annually approximately 10% of the two million tonnes of salmon produced globally (FAO, 2016). British Columbia is also one of the few regions in the

Abbreviations¹: APC, (artificial positive clone); AS, (Atlantic salmon); BC, (British Columbia); CFIA, (Canadian Food Inspection Agency); CI, (confidence interval); CNS, (central nervous system); Ct, (cycle threshold); FHZ, (fish health zone); GI, (gastrointestinal); LOD, (limit of detection); OIE, (Office International des Epizooties); OR, (odds ratio); PS, (Pacific salmon); qPCR, (real-time polymerase chain reaction); STA, (specific target amplification)

[☆] Data: Microbiological and histopathological data are available on request from Drs. Miller (Kristi.Saunders@dfo-mpo.gc.ca) and Ferguson (hf.fishpathology@gmail.com), respectively.

* Corresponding author.

E-mail address: iagardner@upeil.ca (I.A. Gardner).

¹ See Table 1 for abbreviations for specific infectious agents

<https://doi.org/10.1016/j.aquaculture.2018.08.072>

Received 6 April 2018; Received in revised form 18 June 2018; Accepted 29 August 2018

Available online 30 August 2018

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are withheld pursuant to section
sont retenues en vertu de l'article**

68(a)

**of the Access to Information Act
de la Loi sur l'accès à l'information**

Jones, Simon

From: Therriault, Thomas
Sent: Thursday, September 27, 2018 1:32 PM
To: Hyatt, Kim; Higgins, Mark; Johnson, Stewart; Sutherland, Terri; O, Miriam; Coyle, Theraesa; Pearce, Chris; King, Jackie; Robinson, Cliff; Neville, Chrys; Miller-Saunders, Kristi; Jones, Simon; Garver, Kyle; Chandler, Peter; Bianucci, Laura; Murray, Cathryn; Dobson, Diana; MacWilliams, Christine
Cc: Lowe, Carmel; Holmes, John; Kennedy, Eddy; Houston, Kim; MacDougall, Lesley; Thiess, Mary
Subject: RE: Aquaculture Risk Management Framework and the Application of the Precautionary Approach
Attachments: Application of the Precautionary Approach_TT.docx
Follow Up Flag: Follow up
Flag Status: Completed
Categories: Yellow Category

Mark,
Here are my comments on this document.
Also happy to discuss further if needed.
Cheers,
Tom

From: Hyatt, Kim
Sent: Wednesday, September 26, 2018 3:40 PM
To: Higgins, Mark <Mark.Higgins@dfo-mpo.gc.ca>; Johnson, Stewart <Stewart.Johnson@dfo-mpo.gc.ca>; Sutherland, Terri <Terri.Sutherland@dfo-mpo.gc.ca>; Therriault, Thomas <Thomas.Therriault@dfo-mpo.gc.ca>; O, Miriam <Miriam.O@dfo-mpo.gc.ca>; Coyle, Theraesa <Theraesa.Coyle@dfo-mpo.gc.ca>; Pearce, Chris <Chris.Pearce@dfo-mpo.gc.ca>; King, Jackie <Jackie.King@dfo-mpo.gc.ca>; Robinson, Cliff <Cliff.Robinson@dfo-mpo.gc.ca>; Neville, Chrys <Chrys.Neville@dfo-mpo.gc.ca>; Miller-Saunders, Kristi <Kristi.Saunders@dfo-mpo.gc.ca>; Jones, Simon <Simon.Jones@dfo-mpo.gc.ca>; Garver, Kyle <Kyle.Garver@dfo-mpo.gc.ca>; Chandler, Peter <Peter.Chandler@dfo-mpo.gc.ca>; Bianucci, Laura <Laura.Bianucci@dfo-mpo.gc.ca>; Murray, Cathryn <Cathryn.Murray@dfo-mpo.gc.ca>; Dobson, Diana <Diana.Dobson@dfo-mpo.gc.ca>; MacWilliams, Christine <Christine.MacWilliams@dfo-mpo.gc.ca>
Cc: Lowe, Carmel <Carmel.Lowe@dfo-mpo.gc.ca>; Holmes, John <John.Holmes@dfo-mpo.gc.ca>; Kennedy, Eddy <Eddy.Kennedy@dfo-mpo.gc.ca>; Houston, Kim <Kim.Houston@dfo-mpo.gc.ca>; MacDougall, Lesley <Lesley.MacDougall@dfo-mpo.gc.ca>; Thiess, Mary <Mary.Thiess@dfo-mpo.gc.ca>
Subject: RE: Aquaculture Risk Management Framework and the Application of the Precautionary Approach

Hi Mark! My comments provided in margins of attached document. Let me know if they require any clarification.

Regards, Kim.

Kim D. Hyatt Ph.D.
Section Head, Regional Ecosystem Effects on Fish and Fisheries
Science Branch, Ecosystem Science Division, Fisheries & Oceans Canada
Pacific Biological Station, Nanaimo, BC V9R 6N7
T: 250 756 7217
F: 250 756 7138
Associate Editor, *Canadian Water Resources Journal*, NRC Research Press

From: Higgins, Mark
Sent: September-26-18 12:36 PM
To: Johnson, Stewart; Sutherland, Terri; Therriault, Thomas; O, Miriam; Coyle, Theraesa; Pearce, Chris; King, Jackie; Robinson, Cliff; Hyatt, Kim; Neville, Chrys; Miller-Saunders, Kristi; Jones, Simon; Garver, Kyle; Chandler, Peter; Bianucci, Laura; Murray, Cathryn; Dobson, Diana; MacWilliams, Christine
Cc: Lowe, Carmel; Holmes, John; Kennedy, Eddy; Houston, Kim; MacDougall, Lesley; Thiess, Mary
Subject: FW: Aquaculture Risk Management Framework and the Application of the Precautionary Approach
Importance: High

Dear all,

Some of you have already been contacted with this request, but I wanted to ensure everyone is on the same page. Please find attached the document on which Ottawa is looking for comment. See below for further details. There may be a call/meeting to discuss any comments received sometime next week, so if you could pass any comments to me by Tuesday, October 2nd, that will give us time to assess how to proceed from there. We are hoping that we can get comments from as many as possible before returning this to Ottawa. If you have any questions, please let me know.

Thanks

Mark Higgins
A/Division Manager ADGT
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From: Lowe, Carmel
Sent: September-19-18 12:05 PM
To: Higgins, Mark; Holmes, John; Kennedy, Eddy
Cc: MacDougall, Lesley; Houston, Kim; Patten, Bruce
Subject: FW: Aquaculture Risk Management Framework and the Application of the Precautionary Approach
Importance: High

All – see below and attached.

Mark – I would like you engage the others on this email and provide me with a list of the staff that should be included in a review of this draft approach. I propose we then convene a meeting of those staff and those on this email to conduct

the review and provide a consolidated response back to Jay and Ingrid. Let me know if there are any issues/concerns with this proposed approach – and if so, what are alternate suggestions completing the review.

I will ask Catherine to find a time for this regional review meeting during first week of October. I am guessing we will require 2 hours.

Carmel

Carmel Lowe, Ph.D.
Regional Director Science | Directrice régionale des sciences
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From: Parsons, Jay

Sent: September 19, 2018 11:48 AM

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Subject: Aquaculture Risk Management Framework and the Application of the Precautionary Approach

Importance: High

Le français suit

Colleagues,

As mentioned Monday, a draft Aquaculture Risk Management Framework/Application of the Precautionary Approach has recently been developed, in response to the Minister's request that the Department explain how aquaculture is managed and how the precautionary approach is applied. This supports a number of high profile and public expectations, including the Cohen Commission report, the Minister's mandate letter and the Spring 2018 report from the Commissioner for the Environment and Sustainable Development.

It is important to note that this document is very much still a work in progress. For example, the intention is to balance this document nationally by including additional examples in Annex 2 incorporating east coast applications.

Prior to engaging with the Provinces, Territories and Indigenous Peoples, comments and feedback internally is being sought. Aquaculture Management sent out a version Tuesday to their RDs seeking their comments on the applicability of the framework to aquaculture, and changes and/or improvements.

The attached version is the most recent and current version and should be used for the purpose of review. Unfortunately, it is currently only available in English; the translated version will be sent when it becomes available.

Aquaculture Management has requested feedback by **Friday October 12, 2018**. Therefore, the comments from EOS will also need to be submitted by that time as well.

We ask that you broadly engage the DFO Science community within your region (i.e., in addition to aquaculture staff, also fisheries science and habitat science staff, etc.).

Please send your collated comments, corrections and suggestions to Ingrid Burgetz and Jay Parsons, with a cc to Wayne Moore by October 12th. Ingrid and Ed Porter from Aquaculture Management will then integrate all the comments into the next version. As well, we have been asked to convene a departmental technical review meeting of the document with internal (Science and Management) and external experts. We will soon be approaching you for suggested regional participants (Aquaculture / Fisheries / Habitat Science). This will also be an additional or alternate approach to providing regional input into the document.

Next steps following this include:

- DFO finalization of the document for external consultation, including presentation to the Minister
- DFO Science & Management internal and external technical review (details to be shared shortly)
- Consultations with P/T through the Canadian Council of Fisheries and Aquaculture Ministers
- Industry consultation
- Indigenous consultations
- Public consultation (on DFO website)
- Final posting on DFO's website

Thank you very much to your collaboration and support.

I apologize for the tight timelines, but this file has the express interest of the Minister.

Chers collègues,

Comme mentionné lundi, une ébauche du cadre de gestion des risques liés à l'aquaculture et de l'application de l'approche de précaution a récemment été élaborée en réponse à la demande du ministre voulant que le Ministère explique la façon dont l'aquaculture est gérée et dont l'approche de précaution est appliquée. Cela appuie un certain nombre d'attentes publiques de premier plan, y compris le rapport de la Commission Cohen, la lettre de mandat du ministre ainsi que le rapport publié par la commissaire à l'environnement et au développement durable au printemps 2018.

Il est important de mentionner que ce document est loin d'être définitif. Par exemple, pour que ce document soit équilibré à l'échelle nationale, nous souhaitons inclure à l'annexe 2 d'autres exemples d'application sur la côte est.

Avant de collaborer avec les provinces, les territoires et les peuples autochtones, nous désirons d'abord obtenir des commentaires à l'interne. Mardi, l'équipe de la Gestion de l'aquaculture a envoyé une version du document à ses directeurs régionaux afin d'obtenir leurs commentaires sur l'applicabilité du cadre à l'aquaculture, ainsi que des suggestions de modifications ou d'améliorations, le cas échéant.

Vous trouverez ci-joint la version la plus récente sur laquelle vous devez vous baser pour effectuer votre examen. Malheureusement, elle n'est disponible qu'en anglais pour le moment; vous recevrez la version traduite dès qu'elle sera prête.

L'équipe de la Gestion de l'aquaculture a demandé que les commentaires soient fournis d'ici le vendredi 12 octobre 2018. Les commentaires des Sciences des écosystèmes et des océans doivent donc aussi être soumis d'ici cette date.

Nous vous demandons de mobiliser, en plus de votre personnel d'aquaculture, la communauté scientifique de Pêches et Océans Canada (MPO) de votre région (le personnel scientifique des pêches et de l'habitat, etc.).

Veuillez envoyer vos commentaires, vos corrections et vos suggestions à Ingrid Burgetz et Jay Parsons, avec copie conforme à Wayne Moore, d'ici le 12 octobre. Ingrid et Ed Porter de l'équipe de la Gestion de l'aquaculture intégreront par la suite tous les commentaires reçus dans la prochaine version. De plus, on nous a demandé de convoquer une réunion d'examen technique du document avec des experts internes (scientifiques et gestionnaires) et externes. Nous vous contacterons bientôt pour des participants régionaux (Science de l'aquaculture des pêches ou de l'habitat). Ce sera également une approche supplémentaire ou alternative pour fournir une contribution régionale au document.

Par la suite, les prochaines étapes seront les suivantes :

- Le MPO finalisera le document aux fins de consultation externe et de présentation au ministre.
- Les équipes des sciences et de la direction du MPO effectueront un examen technique interne et externe du document (les détails seront fournis sous peu).
- Des consultations seront menées auprès des provinces et territoires par l'intermédiaire du Conseil canadien des ministres des pêches et de l'aquaculture.
- L'industrie sera consultée.
- Les peuples autochtones seront consultés.
- Le grand public sera consulté (par l'entremise du site Web du MPO).
- La version définitive du document sera affichée sur le site Web du MPO.

Je vous remercie grandement pour votre collaboration et votre soutien.

Je tiens à m'excuser pour les délais serrés, mais ce dossier est d'un grand intérêt pour le ministre.

Jay

On behalf of SRS and EOSS

Jay Parsons, PhD

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Application of the Precautionary Approach within a Risk Management Framework for Aquaculture

Commented [TT1]: Overall it is unclear who the intended audience is for this. It seems too detailed for a strategic document but too few details are provided to make it a document that would stand alone for practitioners to use.

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Introduction

Globally, aquaculture continues to grow faster than other major food production sectors, and has been identified by the FAO, as a critical contributor to food, nutrition and employment in the global economy.¹ The Government of Canada recognizes aquaculture's significant benefits to society, including providing full-time jobs in coastal Canada. In Canada, aquaculture is a relatively new industry and is jointly managed by the federal and provincial governments. There is tremendous potential for the Canadian industry to become an even greater player in overall world production. However, societal conflicts over which human activities are acceptable in Canadian waterbodies have created challenges to the growth and sustainability of aquaculture in Canada. This is often expressed as environmental sustainability concerns, ranging from direct environmental impacts to indirect impacts on wild fish health and productivity. A well-defined risk management framework, which embodies a clear understanding of unacceptable potential harm, taking precautionary steps where relevant and fully engaging the public throughout the entire risk-management process can help to clearly communicate where there are environmental risks, and can address both environmental sustainability issues and public concerns.

Fisheries and Oceans Canada's (DFO) mandate relates to the conservation of fish and fish habitat and ~~This applies equally to both fisheries as it does to decisions related to and~~ aquaculture. The starting point for any decisions made by DFO regarding human activities around waterbodies in Canada, including aquaculture, is founded on three key pieces of federal legislation: the *Fisheries Act*, the *Oceans Act* and the *Species at Risk Act*. Consequently, in executing the Department's fiduciary duty, the conservation of fish and fish habitat requires the conservation of biodiversity within the ecosystem, and the habitat and productivity of fish species. Given the complexity of ~~detecting or monitoring~~ changes in biodiversity or productivity, proxies ~~often~~ are used as practical measures for managing the environment. Therefore, the threshold for unacceptable harm to fish or fish habitat is any activity that has the potential to cause a population-level effect to fish species.

~~In addition~~ Also, there are international commitments and best practices that are relevant to the management of human activities. The Rio Declaration of the UN Conference on Environment and Development (UNCED) supports the right of sovereign states to pursue responsible economic development opportunities as long as other member states or future generations are not negatively impacted by such developments. The notion of the Precautionary Approach (PA) is geared towards large-scale threats, especially when the consequences are serious or irreversible (e.g., climate change).

Many governments apply the precautionary principle as part of an overall risk management framework to activities that may not potentially result in large-scale or permanent environmental impacts, but may be activities that have societal concern. It is within this context, that DFO applies precaution as required in delivering its regulatory and legislative responsibilities for aquaculture.

Commented [TT2]: What about the Territories ?

Commented [TT3]: This should not be defined here. The framework should identify the risk/harm which is characterized later.

Commented [TT4]:
It is conceivable that almost any activity has the potential to cause harm (hence the need for assessment) but isn't the goal to identify those that have a higher likelihood or probability? The only true measure of this would be once the threshold is passed but by then it is too late.

Commented [TT5]: Not sure how we actually got to this conclusion here. Is this wording directly from one of the Acts or is this the basis for the framework ?

Commented [TT6]: Clearly there are many of these with varying degrees of applicability here. Why this specific example ?

Commented [TT7]: Expand ?

Commented [TT8]: Again, seems some linkage is required here for context.

Commented [TT9]: The reverse is also true but not noted but perhaps more problematic is that both scale and duration (i.e., permanent) are not well defined here or elsewhere in the document. For example, is large-scale a bay, a part of a bay, or the entire ocean? Similarly is permanent measured in a government's term, a human generation or geological time?

¹ FAO - The State of World Fisheries and Aquaculture 2018

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The following risk management framework for aquaculture is consistent with the overarching Sustainable Fisheries Framework. It also builds on the 2008 Aquaculture Policy Framework (APF) and specific policies developed to support DFO's B.C. Aquaculture Regulatory Program (BCARP).

Moreover, this Framework is not meant to create any new legal obligations to apply precaution. DFO's role in regulating the aquaculture sector is fundamentally linked to, and is consistent with, the overarching Sustainable Fisheries Framework. (SFF). The SFF provides the foundation for an ecosystem-based and precautionary approach to fisheries management in Canada, and provides the basis for ensuring ~~Canadian~~ fisheries are conducted in a manner which support conservation and sustainable use. Ultimately, through integration with the broader SFF, the residual effects of aquaculture on fish and fish habitat, following all mitigative actions, ensures that these effects can be taken into account in the sustainable management of fisheries.

DFO'S Approach to Aquaculture Management

Aquaculture Management Objectives

The overarching departmental aquaculture management objective is to create the conditions for a successful and sustainable aquaculture industry across Canada. Within the overall objective, the department's goal for aquaculture is to ensure that fish and their habitats are protected using regulatory mitigation, monitoring and compliance approaches that are efficient, effective and aligned with the potential risk to the environment, and integrated (to the extent possible) with broader fisheries management approaches. **Specifically, the threshold for unacceptable harm to fish or fish habitat is any activity that has the potential to cause a population-level effect to fish species.** Recognizing that aquaculture is managed federally and by provincial and territorial governments, the department's overall assessment of risk will consider risk management and mitigation measures by all regulatory partners.

An Ecosystem and Precautionary Approach

Ecosystem approaches recognize that humans are part of, and have significant influences on, their environments. In aquaculture management under an ecosystem approach—as in fisheries management more broadly—regulatory decisions consider the impact of human activities on fish species, habitats, and the ecosystem of which these species are a part, and take into account broad ecosystem changes related to weather and climate. **While it is recognized that all habitats, species, populations and communities play a role in aquatic ecosystems, some are more important from an ecological perspective and some are more resilient than others.**²

DFO incorporates a precautionary approach within its ecosystem approach to fisheries management decision-making, supporting the economic use of resources while ensuring that

Commented [TT10]: As above, it seems this wording should be scoped more.

Commented [TT11]: How consistent is this with the SARA concept of acceptable harm? Is it simply the opposite wording?

Commented [TT12]: In some places it is Fed/Prov but here territories are included. Seems this should at least be consistent within the document.

Commented [TT13]: Consider linking explicitly to EBSAs and/or ESSs. Maybe some examples?

² *Principles of Ecosystem Based Fisheries Management*: <http://www.dfo-mpo.gc.ca/fm-gp/peches-fisheries/fish-ren-peche/sff-cpd/ecosys-back-fiche-eng.htm>.

potential risks to aquatic environments are managed to ~~prevent~~ minimize harm to fish populations and habitat, and to limit other less serious harm to the extent feasible given available technology and costs. Management decisions often are more cautious when scientific information is uncertain, unreliable or less complete.³

Commented [TT14]: Can't actually prevent in this case.

Commented [TT15]: Not clear how a multi-stage approach to harm is being defined/used here. What does less serious look like?

Commented [TT16]: Isn't this precautionary? It seems cautious and precautionary shouldn't be used interchangeably as they are different.

Implementing an Ecosystem Approach in Aquaculture

An efficiently and effectively applied ecosystem approach for managing aquaculture in Canada includes risk management that considers potential environmental impacts holistically to enable the evaluation of ecosystem level impacts. This integrated strategy is supported through a risk management framework. The holistic evaluation of impacts is supported by the use of the Pathways of Effects (PoE) model for aquaculture (see next section).

Commented [TT17]: Wouldn't this framework also allow consideration of other levels? This could be quite useful if there is a specific sub-ecosystem level impact managers were trying to avoid.

Commented [TT18]: But there are other potential approaches that could be used. Is DFO committed to PoE even though these are very resource intensive and some situations might allow alternative approaches to be used? Are PoE libraries complete for aquaculture? Perhaps more problematic is the fact that risk determination is not clearly articulated outside of PoE (which are not a risk assessment tool).

Taken as a whole, this approach is designed to support the consistent regulatory management of related aquaculture activities while identifying location, species or operational-specific factors that may influence the extent of the impact on the environment in a particular situation.

Commented [TT19]: Assume this includes spatial extent, temporal duration and some measure of magnitude/persistence?

Aquaculture Environmental Risk Management

There are five major elements in the Department's approach to managing the environmental risks that may arise due to aquaculture activities (Figure 1, below).

- (1) Defining the environmental and ecosystem objectives for aquaculture activities in Canada: these objectives are defined within legislation, through intergovernmental and international agreements, and consideration of societal values;
- (2) Issue identification: these can be identified through the results of scientific research, monitoring of environmental changes, and/or through public engagement;
- (3) Risk assessment: the science-based characterization of the likelihood and consequence of an activity and assessment of the overall risk, based on the current state of knowledge, and, the identification of uncertainty;
- (4) Risk management: this includes the assessment of how to address uncertainties identified risks through applying regulatory and precautionary measures and options for regulatory measures (mitigation and compliance/effects monitoring), and management decisions on mitigation, monitoring, and licencing; and,
- (5) Monitoring and evaluation of the activity against the identified risks and management actions.

Commented [TT20]: I can see that the overarching objectives would be National but in this context (including Fig 1) Isn't there scope for this applying to specific activities in specific locations. This would be more consistent with the typical scoping phase that would be next.

Commented [TT21]: To me this is much more than just dealing with the uncertainties.

Throughout this process, communication and feedback are critical.

Integral to this process is that management decisions are based on many considerations, including, but not exclusively, scientific, social, economic, cultural and political. It is important to note that not all aquatic areas require equal levels of protection, as not all areas are equally ecologically or biologically significant or vulnerable.

Commented [TT22]: Agree this needs to be highlighted but also important to note somewhere that the risk of the aquaculture activity is evaluated for each area specifically. This hasn't really been explicit in the document to this point.

³ A Fishery Decision-making Framework Incorporating the Precautionary Approach: <http://www.dfo-mpo.gc.ca/fm-gp/peches-fisheries/fish-ren-peche/sff-cpd/precaution-eng.htm>.

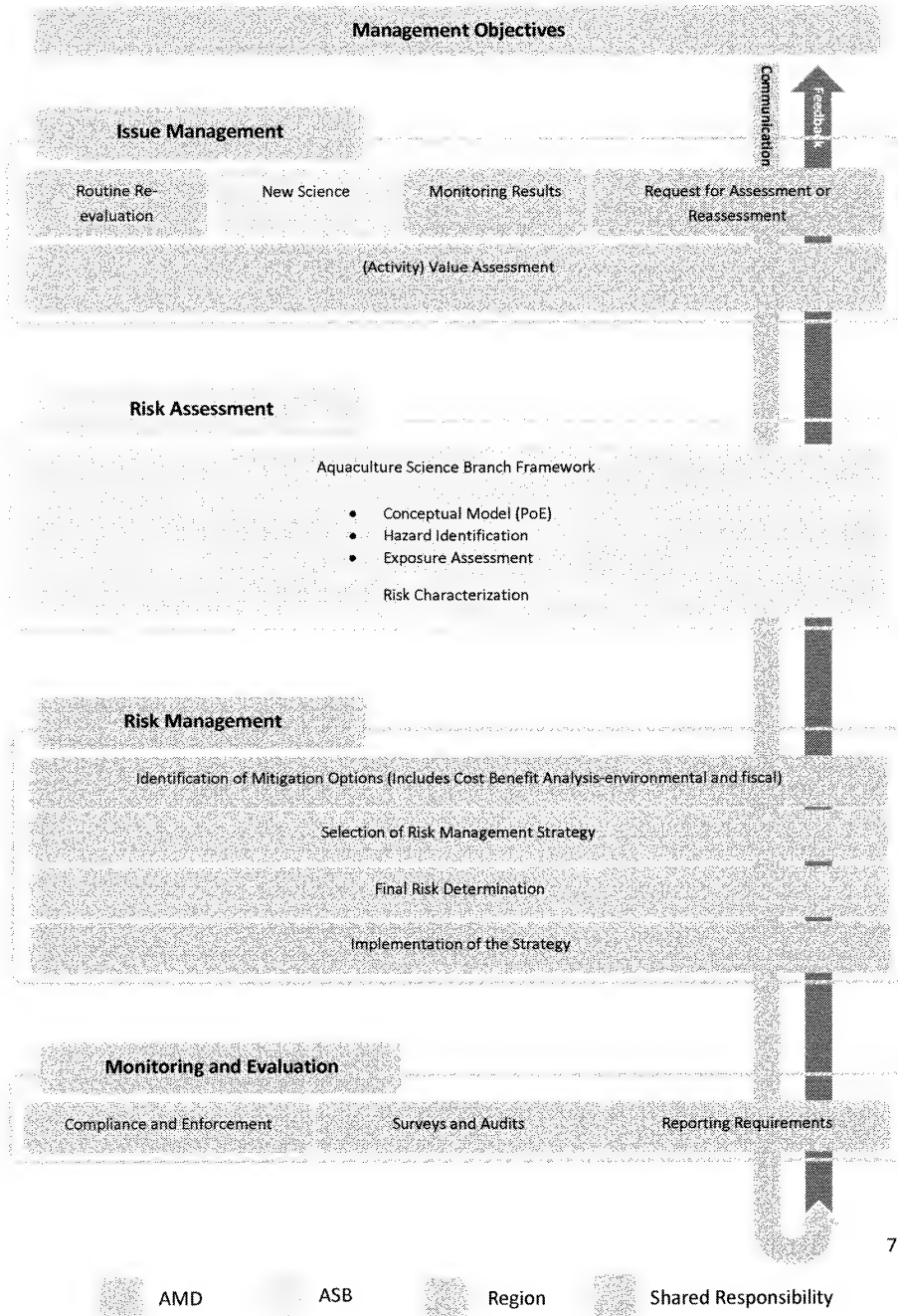
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Figure 1: Aquaculture Environmental Risk Management Framework

Commented [TT23]: I get the idea of the communication/feedback arrows but despite potential cluttering of the diagram there are important loops within each of these elements as well.



Management decisions should also take it into consideration, as may be available, Indigenous Peoples traditional and ecological knowledge.

Commented [TT24]: I would argue this statement is too restrictive and that TEK/LEK be incorporated in all elements where possible.

This approach supports management decision-making with respect to both (1) the setting of broad management (mitigation and monitoring) measures, such as siting criteria and general conditions on operations; and, (2) the consideration of individual applications (e.g., new or amended licences), ~~focussing~~ focusing resources on risks that are unique to the proposed application.

Pathways of Effects (PoE) Model

A Pathways of Effects (PoE) model is a tool that can convey complex interactions between human activities, the stress they can place on the environment (pressures), and environmental effects or impacts. The model operates on the premise that human activities can place stress on the environment which, in turn, can lead to various environmental effects. The model recognizes that a single source activity can result in one or more environmental stressor and that these environmental stressors can have multiple source activities and can lead to one or more environmental effects. It also recognizes that a single environmental effect can be influenced by one or more stressors or activities.

Commented [TT25]: Should we also note what PoEs might not do as well with respect to cumulative effects?

PoE diagrams group similar components together at each level in the model (activities, stressors and effects), noting inter-linkages in text descriptions of the environmental considerations. These diagrams and descriptions are designed to communicate information in a manner that facilitates the consideration of overall impacts on the environment, and the ecological benefits and costs of various potential management measures, including interactions between measures and cumulative impacts.

Commented [TT26]: It seems more accurate to say that PoEs are a tool that allow managers to consider the potential ecological costs/benefits of actions. The tool itself doesn't do this per say.

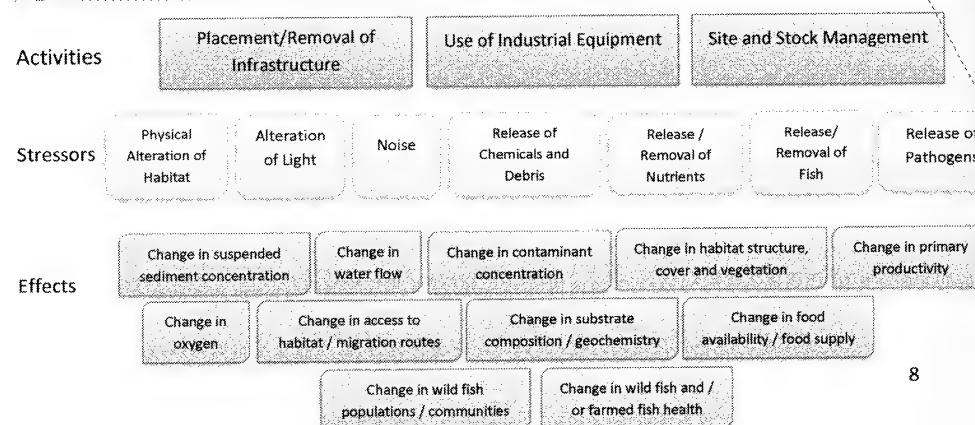
The scientific basis for links between aquaculture activities, stressors and effects was peer-reviewed through DFO's Canadian Science Advisory Secretariat process, and the summaries of the scientific state of knowledge for each of the stressors. This information is available for use in the evaluation of aquaculture activities and the identification of where management intervention may be required to protect fish and/or fish productivity/populations.

Commented [TT27]: Disagree, the tool won't tell you if the cumulative impacts unless the assessor specifically knows how multiple stressors interact at each site/assessment area. Clearly DFO is working on this but I think it is premature to state strongly here.

Commented [TT28]: Link?

Commented [TT29]: Incomplete sentence

Figure 2: Pathways of Effects for Finfish and Shellfish Aquaculture



Commented [TT30]: I think this document should highlight that Fig 2 is a potential starting point but there could be additional activities, stressors and effects (not shown) that could be important in specific cases and added to the PoE model to be considered in the RA.

Commented [TT31]: So is this set in stone because it is based on existing CSAS advice? Seems there are other activities, stressors or effects that could be considered. Also, not clear why the text below only focuses on stressors, especially if this has already been approved. To me it might be more informative to walk through a chain (activity-stressor-effect) rather than brief review of stressors.

At the specific aquaculture application level, the linkages between each of the stressors and the relevant effects are considered. The specific environment and activity will determine which stressor-effect linkages exist, and what mitigation measures can be used to effectively and sustainably break the stressor-effect linkages.

Commented [TT32]: But how is risk assessment being linked to PoE? I think this document needs to articulate how the major risk components (likelihood and impact) will be determined/quantified. The PoE will only articulate the relationships, the specifics for the RA will need to be determined and subsequently can be adjusted when management actions are considered.

Commented [TT33]: Isn't reduction in pressure an option here? Does it always have to break the relationship?

- **Physical alterations to the habitat** occurs when activities related to placing or removing physical infrastructure (e.g. net pens, longlines, rafts, anchors and moorings, shellfish beach culture structures), as well as during the use of husbandry equipment (e.g. underwater lights to increase growth in marine finfish or acoustic deterrent devices to discourage predators⁴).

The extent and impact of the predicted physical alterations to habitat are considered primarily during the pre-operational stage (e.g. site application), which includes an evaluation of the type of benthic habitat in the area being proposed for aquaculture.

- **Release of chemicals and debris** occurs primarily with activities associated with site and stock management, and the use of operational equipment where chemicals and debris may be released. Examples include the use of pesticides, drugs and antifouling agents, and the use of materials in construction (e.g. steel, wood, floatation) and operations (e.g. feed bags, ropes), which can be lost from sites as debris.

The effect of the use of pesticides, drugs and antifoulants on the receiving environment, including on non-target organisms, is assessed by Health Canada.

- **Release of organic and related matter** occurs as a result of stock management activities (e.g. the feeding and cultivation of fish, removal or natural sloughing of biofouling organisms from physical infrastructure) that have an organic or related component (e.g. nutrients).

The predicted extent of organic deposition on the surrounding seafloor is assessed at the pre-operational stage. As part of the on-going operational compliance, marine finfish aquaculture operations must meet a performance-based regulatory requirement related to the release of organic matter.

Commented [TT34]: And other related components or just organics?

- **Removal of nutrients and organic matter** occurs as a result of stock management activities where some cultured species (e.g. bivalves) remove particulate matter, nutrients and oxygen from the water column.

The predicted extent of the removal of nutrients on wild populations is assessed at the pre-operational stage.

⁴ Note that the use of acoustic deterrent devices is not a current practice in Canadian aquaculture.

- **Release or removal of fish** occurs primarily as a result of stock management activities.

The removal of fish is considered and managed as bycatch. This occurs when some individual wild fish may be temporarily or permanently removed from waters along with cultured fish (e.g. during grading or at harvest), or as part of biofouling or predator control.

The addition of fish to the environment occurs either as a result of intentional stocking of cultured fish into aquatic environments for cultivation (e.g. salmon enhancement), or as a result of unintentional release of fish (e.g. escapes).

The impact on wild populations from the unintentional release of cultured organisms is considered at the pre-operational stage, and is also linked to fiduciary responsibilities associated with the *Species at Risk Act*.

- **Release of pathogens and pests** occurs associated with site and stock management. The increase in biomass of fish within an aquaculture site can influence the presence or abundance of fish pathogens (e.g. bacteria, viruses) and pests (e.g. sea lice and tunicates).

The introduction of pathogens or pests is evaluated at the operational stage, primarily by the Introductions and Transfers Committees (ITC). Conditions of licence outline mitigation measures for the management of the abundance of pathogens or pests.

Additionally, notifiable diseases are regulated by the Canadian Food Inspection Agency.

Commented [TT35]: I'd suggest noting AIS separately in Fig 2 and associated text.

Additional details on the characterization of each of the stressors, the current status of regulatory thresholds, and current management and mitigation practices are found in Annex 1. Also, a case study for the management of sea lice in B.C. is found in Annex 2.

Commented [TT36]: We also have conditions of licence to limit the inadvertent movement of AIS (at least in BC). This should be noted as well.

Stakeholder and Indigenous Peoples' Engagement

Stakeholder and Indigenous peoples' engagement to support sound aquaculture governance is critical. The lack of social licence is a major barrier to robust aquaculture growth. Other factors, including the type of regulatory regime or site-specific development capacity characteristics, may play a role, but not to the same extent as societal acceptance. The best mechanism for sustainable growth is via coastal zone and area-based management approaches which fully engage interested stakeholders and indigenous groups, who may actually contribute to decision-making. These processes not only support general agreement of where sites should go, but also the areas of greatest concern ~~to focus on~~.

It should be recognized that some risks are new or emerging, and the evolution of scientific knowledge may influence society's tolerances and its chosen level of protection. An understanding of the "public's tolerance for risks" or "society's chosen level of protection" underpins the need for high transparency, clear accountability, and meaningful public involvement and communication.

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Two-way sharing of information and the inclusion of a range of perspectives in the decision-making process can become the cornerstone of openness and transparency, and enhance credibility of and trust in the decisions that the Government develops.

Conclusion

DFO has managed aquaculture over the years based on managing environmental impacts and the potential risks these can pose to fish habitat and fish populations, as identified through the DFO peer-reviewed science process. Where relevant, DFO regulators strive to develop management standards or thresholds, which are informed by science, based on best practices globally, and have received some form of stakeholder and indigenous peoples' input.

Aquaculture management is a shared responsibility between the federal and provincial governments; thus, management frameworks need to be foundationally the same. In circumstances where there is a potential for unacceptable harm to fish (population-level effects), it may be appropriate to make decisions and implement precautionary measures in the near term, without having full certainty of the probability or magnitude of harm. Close monitoring would also occur to assess the effectiveness of the measures in addressing mitigating risk and overall impacts. Follow-up activities, including research and monitoring, are key to reducing scientific uncertainty and allow improved decision-makings to be made in the future. Finally, stakeholder and Indigenous peoples' engagement throughout the risk management process is critical, not just at the final decision-making process.

Annex 1: Details on Aquaculture Stressors, Effects and Risk Management

STRESSOR	THRESHOLD	MANAGEMENT ACTION / MITIGATION
<p>Release of pests and pathogens</p> <p>Pathogens can be endemic in wild fish populations (i.e., occur naturally in wild populations in a region) or exotic (i.e. occur naturally in other locations and have been introduced in a region). The presence of endemic pathogens can be amplified under some circumstances where fish are in close proximity (e.g. spawning grounds, schooling and aquaculture). Endemic pathogens tend to have a less severe effects on native populations than exotic (or introduced, non-endemic) pathogens, as over multiple generations native species have typically developed an immune response to endemic pathogens.</p> <p>The health status of wild fish often cannot be directly assessed, and changes in wild fish populations or communities due to disease are difficult to determine. Diseased and moribund fish are quickly removed from the population through processes such as predation or mortality; sampling can therefore be easily biased toward healthy individuals. The presence or absence of pathogens is particularly difficult to determine in wild fish populations, nor is there available scientific data to determine the effect of low level presence of pathogens at the individual or population level.</p>	<ul style="list-style-type: none"> Sea lice threshold (B.C. only); Mandatory Reporting of Fish Health Events (i.e., treatment or % loss) (B.C. only) 	<p>Conditions of licence require treatment for sea lice above threshold (3 lice/fish in B.C.)</p> <p>Monitoring fish health is a particularly important mitigation tool when cultured fish are destined for movement to another location or for release into aquatic environments. The determination of the appropriateness of planned movements or releases of fish must be based upon a review of the disease and mortality history of the cohort, on recommendations by a qualified fish health professional, on the results of any recommended pre-release disease screening, and on guidance from regulatory agencies.</p>
<p>Release (or removal) of organic matter and nutrients</p> <p>Potential sources of the release of other organic matter include fish carcasses (e.g. from cultured fish or bycatch⁵), feed spillage, faeces,</p>	<ul style="list-style-type: none"> BOD threshold 	<p>Footprint addressed through initial siting decisions (benthic impact depositional modeling)</p> <p>Performance based threshold (on-going assessment once/production cycle) – under the AAR, sites cannot be restocked</p>

Commented [TT37]: AIS (tunicates) were noted above but no mention here as looks like all finfish. Should this be added as an example for the shellfish world? As noted above there is management related to green crab in BC.

⁵ The release of incidental finfish catch during finfish harvest, as may be required under conditions of licence, may contribute to organic matter in the environment if the fish are dead or have a low chance of survival.

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<p>harvest waste or offal, including blood. Release of organic matter into the marine environment from humans working and/or living on site could also constitute a minor contribution of organic matter to aquatic environments, should it occur. Human waste is generated on boats or in working or living accommodations as part of daily activities like cooking, bathing and bodily functions. The majority of organic matter introduced into the environment from finfish aquaculture will be associated with excess feed and faeces. Accumulation of the organic matter can result in a change in the benthic biodiversity around a site.</p>		<p>if sulphide threshold exceeded</p>
<p>Release of chemicals/drugs</p> <p>Pesticides are assessed by the Pest Management Regulatory Agency of Health Canada for value of use, human, animal and environmental risks under the <i>Pest Control Products Act</i>. Factors considered in environmental risk assessments related to pesticides include the potential transport and dispersal of products and/or their constituents following release into waters, as well as the exposure of non-target organisms to concentrations of substances that could result in lethal or sub-lethal (e.g. behavioural, reproductive) effects. The severity of impacts on exposed non-target species will depend on factors such as the toxicity of the product used, the dosage, the presence of susceptible non-target species / life stages of species, and environmental conditions.</p>	<ul style="list-style-type: none"> No thresholds – Research and analysis underway to provide advice on the design of a post-deposit monitoring program. 	<p>PRMA can place limits on the timing, location and volume of the release of specific materials.</p> <p>Under development – traffic light system for 1) pre-siting assessment to inform site placement, and 2) cumulative impacts [informed by post deposit monitoring program (site level) and aquaculture monitoring program (bay scale)]</p>
<p>Physical alteration of habitat</p> <p>The addition, removal, and</p>	<ul style="list-style-type: none"> Maximum shellfish aquaculture coverage of 7% per bay in some areas of Canada 	<p>Primarily addressed through initial siting considerations.</p> <p>In situations where wild fish may be</p>

modification of physical structures may affect bottom sediments, benthic communities, pelagic communities, and hydrodynamics.		present only on a seasonal basis, or where habitat is used by a species during a particular period (e.g. during reproductive phases), measures to limit the duration, timing or extent of installation, harvest or site maintenance activities may be warranted.
<p>Release (or removal) of fish</p> <p>Farmed finfish, including salmon, may escape, usually due to equipment failure or human error. Equipment failure may be weather-related, caused by predator attacks or other events that stress the containment infrastructure. For there to be genetic intrusion, establishment of non-native populations, predation or competition, farmed fish must first be released into the wild through escape or the release of viable gametes.</p>	<ul style="list-style-type: none"> • Reporting of escapes may be required, depending on jurisdiction • No <i>direct</i> genetic impact risk on West Coast from Atlantic salmon farms 	<p>Addressed through conditions of licence and development of national containment standards (to be developed)</p> <p>Regulation of fish containment structures and use of triploid farmed fish would further lower the extent of direct genetic interaction.</p> <p>In the event that an unintentional release does occur, measures such as escape response plans may help to recover released fish, particularly where a significant risk of harmful interaction with wild populations has been identified.</p> <p>Escape reporting and analysis of the measures employed may be used to help assess the effectiveness of current mitigation measures and develop future facility or regulatory measures, as appropriate. Measures for recording and reporting cultured fish inventories as well as accurate records of introductions and transfers of licensed species support a broader understanding of the scope (estimated quantity, species and timing) of unintentional releases, and may form part of the management approach in mitigating their effects.</p> <p>In circumstances where a new species is being considered for rearing in an area for the first time, a specific environmental risk assessment is warranted to determine whether or not an Introductions and Transfers licence should be issued (see National Code on Introductions and Transfers LINK). The Code provides guidance that the I&T risk assessment should typically focus on incremental risk aspects that are particular to that species. Species identified as higher risk may have special regulatory conditions imposed on</p>

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		<p>them to bring the risk to an acceptable level. Where risk outcome warrants, some species may not be authorized for culture. An I&T risk assessment may also be warranted where a species is native to the province but new to culture. In terms of risks related to release of fish, the assessment should start by focussing on the probability of the cultured gametes interacting with wild fish populations, and in the case of finfish, the potential for escaped fish to interact and compete with populations of the same or other species.</p>
<p>Noise</p> <p>Noise associated with aquaculture operations may be produced incidentally during the routine operation of equipment such as aerators, feeders, generators and power washers, and by vessels servicing aquaculture facilities. The effects of such noise are expected to be localized, short-term and likely insufficient to cause injury or permanent displacement to marine organisms.</p>	None	<p>Addressed through initial siting considerations and conditions of licence</p>
<p>Alteration in light</p> <p>Measurements of light penetration around net pens show that little visible light is found outside the pens, which suggests that the use of lights in aquaculture will have minimal and mainly local ecological effects.</p>	None	<p>Addressed through initial siting considerations and conditions of licence</p> <p><i>In B.C. is there still a requirement to report the use of lights?</i></p>

Annex 2: A Case Study- Management of Sea Lice in B.C.

1. Description of Stressor and Potential Impact – Sea Lice

Environmental

The release of pathogens or viruses from aquaculture facilities through site and stock management is a stressor described in the Canadian Science Advisory Secretariat (CSAS) research document “Pathways of Effects for Finfish and Shellfish Aquaculture” (PoE). The primary effect associated with this stressor, as described in the PoE, is a change in wild fish and/or farmed fish health. Additional sea lice specific science advice has also been provided, and this case study and analysis draws on this advice⁶.

Sea lice are endemic to the Pacific Coast and are found on several species of Pacific salmon and non-salmonid species. They are also present in other areas of the world where Atlantic salmon reside, such as Norway and Scotland. There are a number of sea lice species throughout the world that have a range of hosts and life cycle characteristics. The species of concern in B.C. from an aquaculture perspective is the *Lepeophtheirus salmonis* (Salmon louse); however, there is another species, *Caligus clemensi* (Herring louse) which can occasionally cause concern in aquaculture facilities. The sea lice life cycle includes numerous stages, such as: the free-floating Nauplius stage, infectious copepodid stage, attached chalimus stages, and finally the motile stages (pre-adults, adults).

Farmed Atlantic and Pacific salmon are stocked at the marine sites free of lice and infection occurs by exposure to passing adult wild salmon. This is known as “spillover.” The intensity of infestation on farmed salmon is based on a number of factors including the size of the wild salmon run, sea water temperature, salinity and the health of the farmed fish. Cultured Pacific salmon are less susceptible to sea lice infestation than Atlantic salmon. When infestation occurs at a farm the sea lice numbers may become internally amplified, which may result in “spillover” to wild salmon. Of particular concern is the effect this may have on juvenile salmon smolts which have recently entered the marine environment as they are most susceptible to sea lice. Wild salmon smolts out-migrate from their natal streams during the spring and early summer. A corresponding “out-migration window” with different requirements for management of lice levels is incorporated into the licence conditions. The out-migration window as currently defined runs from March 1st until June 30th annually.

Social

There is a high level of concern from a segment of the public, some First Nations and ENGOs, on

⁶ Assessment of Sea Lice Monitoring and Non-Chemical Measures, DFO 2014 [SAR 2014/006](#)

the impact aquaculture has on wild Pacific salmon, and more specifically belief that sea lice can significantly negatively impact wild salmon populations. Wild salmon populations can be highly variable and in some cases a low run in one year can be followed by record high numbers; this happens in areas both with and without aquaculture facilities on migratory routes. Conflicting opinion about the possible impact of high levels of sea lice has not given these groups, governments, the media or the Canadian public a level of comfort that the Department is properly managing the risk the aquaculture industry may pose to wild salmon.

Commented [TT38]: But it often is impossible to reach agreement on opinion which is where scientific evidence comes in. Clearly there are many factors affecting salmon productivity year to year and aquaculture may or may not be contributing. Thus, the strength is in a robust approach that considers or even quantifies these in a way that is clear to stakeholders and FN. In many cases this will include new science but should this be linked also to near- and far-field effects work or environmental monitoring?

2. Current Management and Mitigation – Sea Lice

The goal of the current management approach is to ensure that no disease or disease agent negatively impacts the protection and conservation of fish. Presently, risk related to sea lice is managed through licence conditions and the Fish Health auditing program.

Commented [TT39]: Not sure what this means

Pre-Operational Management Approach

The Precautionary Approach is applied during the consideration of new sites, both from a site-specific and broader area perspective. This is also true for applications for increased production at an existing site. There is recognition of the potential risk of increased sea lice abundance and corresponding infection of out-migrating salmon from licenced facilities as a result of increased production. Assessments including the history of sea lice abundance levels at that farm and neighbouring farms in the general area include recommendations for mitigation measures, such as area-based management (e.g. coordinated and timing of stocking, fallowing and sea lice treatments), maintenance of single-year classes, practicing integrated pest management, and timing of stocking to reduce the need for sea lice treatments. Geographic elements considered during the assessment include hydro-connectivity between the proposed site and adjacent farms, and proximity to known salmon migration routes.

When siting new facilities, efforts are made to avoid the siting of new aquaculture facilities in areas which are known to be important wild fish migration routes, nurseries, sensitive habitats, or have other importance to wild fish populations or significant to First Nations. Ongoing science and research forms part of this consideration.

Commented [TT40]: But clearly this is only part of the process as I'm sure decisions have been made to allow activities in areas that at least one stakeholder/FN group would consider significant/important to them. It may help to frame this in the context of the various factors that feed into management decisions but that at the end of the day, when precaution is considered, decisions are made that might not be agreeable to all.

Current Operational Management Approach

The licence conditions include sea lice monitoring protocols as well as sea lice abundance thresholds that a licence holder cultivating Atlantic salmon must abide by. This threshold is set at an average of three motile (pre-adult and adult) lice (*Lepeophtheirus salmonis*) per fish. During the outmigration period, salmon farmers are required to maintain lice levels below the three motile lice threshold. Outside this period, they are not obligated to maintain this threshold, but must notify DFO when they exceed it and develop a mitigation strategy for consideration by DFO officials. This system allows for lice control during the sensitive out-

migration period, but does not require treatment outside this period, thereby reducing the use and potential development of resistance to various sea lice therapeutants. Sea lice sampling on farms is required every two weeks at minimum during the out-migration period, and DFO auditing of the reported numbers and sampling methodology occurs on 50% of all active farms during this time. For the remainder of the year, sampling by industry is only required once per month, but will increase to every two weeks if threshold levels are exceeded.

Mitigation

Companies are increasingly moving towards an area-based management approach where all smolts in a given area are the same year-class and, if treatments are required, they are coordinated between these sites. Treatments are ideally timed in coordination with returning adult wild fish so that all wild fish have left the area before treatment is initiated. This is to avoid reinfection and retreatment which can lead to resistance. Currently the primary sea lice treatment is the use of emamectin benzoate (SLICE), which is an in-feed parasiticide.

In some areas in B.C., SLICE resistance has emerged in recent years. Industry is rapidly developing alternative treatment modalities to curtail SLICE resistance, and prevent the development of wide-spread resistance in the sea lice population in B.C. This involves the rotational use of alternative treatment methods, such as novel in-feed parasiticides, hydrogen peroxide baths and/or mechanical sea lice removal (e.g. Hydrolicer). An alternate method of reducing absolute sea lice inventory is through harvesting, which typically would occur when fish are near harvest weight. This method is only effective if harvesting is done at a rate that reduces a farm's absolute sea lice inventory (as defined in the licence).

3. Scientific Certainty – Sea Lice

A large number of scientific studies have been conducted in recent years which have tried to determine what, if any, harm is posed to wild salmon by sea lice spillback from Atlantic salmon farms. No conclusive evidence has been found to suggest that sea lice originating from farms are causing harm to wild stocks on a wide scale. This has largely been accepted by stakeholders and opponents to the salmon farming industry. This indicates that the three motile threshold is sufficiently conservative to mitigate risk to wild salmon posed by sea lice originating from farms. In the rare instances where farms have not been able to control lice levels during the out-migration period (often as a result of SLICE resistance), lice levels are found to be higher on out-migrating salmon smolts. This indicates that lice management on farms is vitally important to prevent an undue lice burden on wild smolts.

Commented [TT41]: Seems an odd title!

Commented [TT42]: So they are causing harm on smaller scales? This wording should be more specific.

Commented [TT43]: Since the title of this section is scientific certainty do we actually know how confident we are in the 3 motile threshold? If we are at 4 are we in the realm of major impacts? It seems there is additional work required to better understand if we might be stacking precaution on precaution which would have a cost to industry.

4. Residual Risk and Application of the Precautionary Approach – Sea Lice

Environmental

A changing climate makes future lice mitigation more uncertain and challenging. In years with warmer water temperatures and increased salinity the management of lice becomes more difficult. This is likely to become more common as time progresses. Additionally, the emergence of SLICE resistance on B.C.'s coast has presented a significant challenge to industry for effective lice management. The adoption of additional treatment options by industry is very welcome and has demonstrated that lice levels should be able to be effectively controlled, despite a changing climate and without sole reliance on SLICE. Effective management is vital to ensure that wide-spread resistance to lice therapeutants does not occur as it has in other jurisdictions. Ongoing research into the genetic determinants of lice resistance, use of cleaner fish, alternative treatments and alternative cage designs/husbandry methods are all very promising, and should be encouraged and supported to allow proactive management by industry. Under the present management regime, the residual risk once operational is determined to be medium. Application of the Precautionary Approach requires that the Department utilize existing and potential new management measures to ensure that the risk stays within an acceptable range.

Context	Risk Attributes		
	High	Moderate	Low
	High		
	Moderate	X	

Commented [TT44]: But the RA should have a timeframe identified, usually this is done at the scoping phase so the risk calculations have an actual basis. Where is this defined?

Commented [TT45]: What does this mean? The actual determination of risk would include mitigative measures already so is this some down weighted formulation? Based on framework above it seems there should have been a risk calculation based on the PoE. It is also not clear that residual risk is entirely related to uncertainty nor is it articulated how uncertainty is characterized/quantified/used in the RM element.

Commented [TT46]: As defined by management?

Commented [TT47]: So normally a RA table would indicate likelihood and consequence. What does context and attributes actually relate to? Further, who determined the underlying colour scheme? This is often determined based on risk tolerance and so it is very unclear how RA and RM are actually being applied in this working example. If not transparent it won't be possible to replicate nor will stakeholders/FN believe the process is transparent.

Social

Based on the level of scientific certainty that sea lice are not causing harm to wild fish populations the level of concern raised by the public is expected to diminish over time. Due to the variable nature of salmon returns there may continue to be a perception that declines in salmon populations are related to sea lice impacts. As noted above, environmental residual risk exists based on changing climate conditions. It is incumbent on DFO to ensure a robust scientific program remains in place to better understand how the change in climate conditions is affecting sea lice, and their interaction with farmed and wild fish. If this scientific research along with changing management requirements (as necessary) is communicated to the public in a pro-active manner, social acceptance should increase.

Commented [TT48]: Is this part intended as a full SE RA?

Commented [TT49]: Again, I think there is confusion over residual risk and uncertainty.

Commented [TT50]: That better characterizes spatial and temporal variables contributing to observed variability/understanding?

Commented [TT51]: But this is based on some expectation of the underlying belief systems of stakeholders/public/FN which I suspect we've not characterized well.

Context	Risk Attributes		
		High	Moderate
	High		
	Moderate		X

Commented [T152]: So this is saying SE risk is Moderate ?
Really not clear how this was determined and similar comments on risk calculations and risk management considerations affecting the underlying colour scheme.

5. Next Steps and Future Developments – Sea Lice

DFO conditions of licence relating to lice have been found to be vague, outdated and sometimes unenforceable. Some preliminary ideas on changes to the licence to allow better regulation, while also providing additional tools and guidance to industry, include:

- Consider moving to adult female-based threshold, rather than current motile threshold.
- Establishment of a farm-based, in addition to a fish-based (as currently used), sea lice threshold (For example, we assume 500 000 fish on farm, with three motiles = 1.5 million lice allowable on a single farm).
- Harvest would no longer be deemed an appropriate management action within the out-migration [would only be used to lower farm-based “absolute sea lice inventory” below farm-level threshold (as mentioned above) before entry into out-migration].
- Change licence condition of “active farm” away from number of pens stocked (more than 3), to absolute number of fish on site for a given time (e.g. active site could be defined as: more than 30 days have passed since the introduction of more than 50 000 fish to a sea site).
- Consideration be given to initiating mandatory sea lice reduction prior to March 1, which is the generic time when out-migration is recognized to start, as stated in licence conditions.
- Implement mandatory post in-feed lice treatment reporting to better monitor efficacy.
 - E.g. 25-30 days have passed since the completion of treatment with an in-feed parasiticide medication.
- Implement prohibition on use of lice chemical therapeutant for a time in response to resistance.
 - E.g. treatment failure could be defined as: “failure to achieve > 60% reduction in pre-treatment lice numbers at the 25-30 day post-treatment counts”.
- SLICE use would be prohibited at that site again during the calendar year.

Moving forward the Department must continue to do scientific research on sea lice and its relationship to farmed and wild salmonids in order to develop a clearer understanding of the possible linkages between the two and the corresponding risk to cultured and wild fish. It should also be cognizant of, review related independent science (science which comes from sources outside of DFO), and react to key new findings by adjusting our research objectives. Operationally DFO must adapt to new science, making changes to present management approaches as necessary.

Although the risk posed by sea lice is considered low based on our present scientific understanding, a Precautionary Approach to the siting of new farms in the future could incorporate the potential of sea lice becoming a higher risk because of changing environmental conditions.

Commented [TT53]: How was this determined? Presumably this is a different calculation than what is presented in both « risk tables » where the residual risk was moderate (which actually implies the original or unadjusted risk was at least as high if not higher.

Over and above the current operational management approach it is recommended that a risk-based traffic light system be implemented that would be tied to some objective measure of sea lice abundance (e.g. number and severity of exceedances). This approach could amalgamate information from an individual farm or a number in a geographic area that have hydro-connectivity. It is well established that sites which have good overall fish health performance, including a low sea lice burden, are less likely to become susceptible to disease.

A green designation would indicate that historically a site has good sea lice management with rare incidences of threshold exceedance and low or negligible mortality indicating a low residual risk to wild salmon. The Department could consider increases in production at these sites. A yellow designation would indicate some recurrent sea lice threshold exceedances that are able to be managed on site without the risk of associated fish health issues and do not represent a notable threat to wild salmon. Increases in production would not be considered and additional management measures may be required. A red designation would indicate serious, significant or repeated sea lice exceedances that could potentially represent a notable threat to wild salmon. Drastic management measures could include reducing authorized production, a requirement to fallow for a significant time period, or cancellation of the licence.

Commented [TT54]: So are these levels based on the PoE/RA/RM elements? Not sure of the basis for these conclusions.

At present there is a lack of flexibility in the licence conditions to require actions such as those outlined for farms designated red as the Department does not have the legislative authority. Moving forward the Department should pursue legislative/regulatory changes to obtain this authority.

APPENDIX I: Marine Finfish Pre-Operational Risk Table

There are a number of elements that are already assessed at the pre-operational application stage and the risks are summarized for senior management in a table.

Farm name:	Company:			
Elements Assessed – Wild Fish and Fish Habitat	Low	Med	High	N/A
Presence/use and interactions with CRA fishery or rare species				
Presence of important fish habitat (e.g. sponge reefs, rockfish nursery, etc.)				
Presence/use and interactions with SARA listed species				
Appropriate distance to salmonid-bearing streams				
Appropriate distance to important herring spawn areas				
Appropriate distance to shellfish beds				
Appropriate depth, currents and benthic substrate				
DEPOMOD predictions acceptable				
Existing seabed conditions (e.g. capable of assimilating waste)				
Historic benthic monitoring results				
Use of lights				
Marine mammal usage & mitigation				
Elements Assessed – Fish Health	Low	Med	High	N/A
Diseases of concern on farm, nearby farms, and in area (if known)				
History of appropriate disease management on farm and nearby farms				
Prudent history of medicant use (if known)				
Hydrological connectivity with other farms & co-management plan(s)				
History of compliance and reporting on FH and SL				
Adequacy of submitted FHM, SOPs and Carcass Management Plans				
Water quality (e.g. DO, water flow; if known) & mitigation				
Natural challenges (e.g. plankton issues, harmful algal blooms; if known) & mitigation				
Fish density appropriate to maintain good FH (if known)				
Species intended to be grown is appropriate for the area				
History of predator stress & mitigation (if known)				
Elements Assessed – Sea Lice	Low	Med	High	N/A
Natural occurrence of sea lice at site				
History of staying below sea lice thresholds during smolt out-migration				
Appropriate use of available tools to manage sea lice in future				
Elements Assessed – Existing Fisheries	Low	Med	High	N/A
CSSP closure on bivalve shellfish beds used in CRA fisheries				
First Nations FSC fisheries/site access				
Commercial fisheries (direct or indirect displacement – reduction in stock				
Recreational fisheries (direct or indirect displacement – reduction in stock				
EFA/test fishery/research area				
Geoduck beds				

Jones, Simon

From: Robinson, Cliff
Sent: Friday, September 28, 2018 8:42 AM
To: Higgins, Mark; Johnson, Stewart; Sutherland, Terri; Therriault, Thomas; O, Miriam; Coyle, Theraesa; Pearce, Chris; King, Jackie; Hyatt, Kim; Neville, Chrys; Miller-Saunders, Kristi; Jones, Simon; Garver, Kyle; Chandler, Peter; Bianucci, Laura; Murray, Cathryn; Dobson, Diana; MacWilliams, Christine
Cc: Lowe, Carmel; Holmes, John; Kennedy, Eddy; Houston, Kim; MacDougall, Lesley; Thiess, Mary
Subject: RE: Aquaculture Risk Management Framework and the Application of the Precautionary Approach
Attachments: Application of the Precautionary Approach Within a Risk Management Frame_CLKR.docx
Categories: Yellow Category

Hi Mark, Just a few comments centered around habitat and 'harm'. I am around today if you require further clarification. Cliff.

Cliff Robinson, Ph.D.
Research Scientist
Regional Ecosystem Effects on Fish and Fisheries Section
Ecosystem Sciences Division
Fisheries and Oceans Canada
Pacific Biological Station,
3190 Hammond Bay Rd, Nanaimo BC V9T 6N7
(250) 756-7049

From: Higgins, Mark
Sent: September-26-18 12:36 PM
To: Johnson, Stewart; Sutherland, Terri; Therriault, Thomas; O, Miriam; Coyle, Theraesa; Pearce, Chris; King, Jackie; Robinson, Cliff; Hyatt, Kim; Neville, Chrys; Miller-Saunders, Kristi; Jones, Simon; Garver, Kyle; Chandler, Peter; Bianucci, Laura; Murray, Cathryn; Dobson, Diana; MacWilliams, Christine
Cc: Lowe, Carmel; Holmes, John; Kennedy, Eddy; Houston, Kim; MacDougall, Lesley; Thiess, Mary
Subject: FW: Aquaculture Risk Management Framework and the Application of the Precautionary Approach
Importance: High

Dear all,
Some of you have already been contacted with this request, but I wanted to ensure everyone is on the same page. Please find attached the document on which Ottawa is looking for comment. See below for further details. There may be a call/meeting to discuss any comments received sometime next week, so if you could pass any comments to me by Tuesday, October 2nd, that will give us time to assess how to proceed from there. We are hoping that we can get comments from as many as possible before returning this to Ottawa. If you have any questions, please let me know.

Thanks

Mark Higgins

A/Division Manager ADGT
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From: Lowe, Carmel
Sent: September-19-18 12:05 PM
To: Higgins, Mark; Holmes, John; Kennedy, Eddy
Cc: MacDougall, Lesley; Houston, Kim; Patten, Bruce
Subject: FW: Aquaculture Risk Management Framework and the Application of the Precautionary Approach
Importance: High

All – see below and attached.

Mark – I would like you engage the others on this email and provide me with a list of the staff that should be included in a review of this draft approach. I propose we then convene a meeting of those staff and those on this email to conduct the review and provide a consolidated response back to Jay and Ingrid. Let me know if there are any issues/concerns with this proposed approach – and if so, what are alternate suggestions completing the review.

I will ask Catherine to find a time for this regional review meeting during first week of October. I am guessing we will require 2 hours.

Carmel

Carmel Lowe, Ph.D.
Regional Director Science | Directrice régionale des sciences
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s.16(2)(c)

From: Parsons, Jay

Sent: September 19, 2018 11:48 AM

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Subject: Aquaculture Risk Management Framework and the Application of the Precautionary Approach

Importance: High

Le français suit

Colleagues,

As mentioned Monday, a draft Aquaculture Risk Management Framework/Application of the Precautionary Approach has recently been developed, in response to the Minister's request that the Department explain how aquaculture is managed and how the precautionary approach is applied. This supports a number of high profile and public expectations, including the Cohen Commission report, the Minister's mandate letter and the Spring 2018 report from the Commissioner for the Environment and Sustainable Development.

It is important to note that this document is very much still a work in progress. For example, the intention is to balance this document nationally by including additional examples in Annex 2 incorporating east coast applications.

Prior to engaging with the Provinces, Territories and Indigenous Peoples, comments and feedback internally is being sought. Aquaculture Management sent out a version Tuesday to their RDs seeking their comments on the applicability of the framework to aquaculture, and changes and/or improvements.

The attached version is the most recent and current version and should be used for the purpose of review. Unfortunately, it is currently only available in English; the translated version will be sent when it becomes available.

Aquaculture Management has requested feedback by **Friday October 12, 2018**. Therefore, the comments from EOS will also need to be submitted by that time as well.

We ask that you broadly engage the DFO Science community within your region (i.e., in addition to aquaculture staff, also fisheries science and habitat science staff, etc.).

Please send your collated comments, corrections and suggestions to Ingrid Burgetz and Jay Parsons, with a cc to Wayne Moore by October 12th. Ingrid and Ed Porter from Aquaculture Management will then integrate all the comments into the next version. As well, we have been asked to convene a departmental technical review meeting of the document with internal (Science and Management) and external experts. We will soon be approaching you for suggested regional participants (Aquaculture / Fisheries / Habitat Science). This will also be an additional or alternate approach to providing regional input into the document.

Next steps following this include:

- DFO finalization of the document for external consultation, including presentation to the Minister
- DFO Science & Management internal and external technical review (details to be shared shortly)
- Consultations with P/T through the Canadian Council of Fisheries and Aquaculture Ministers
- Industry consultation
- Indigenous consultations
- Public consultation (on DFO website)
- Final posting on DFO's website

Thank you very much to your collaboration and support.

I apologize for the tight timelines, but this file has the express interest of the Minister.

Chers collègues,

Comme mentionné lundi, une ébauche du cadre de gestion des risques liés à l'aquaculture et de l'application de l'approche de précaution a récemment été élaborée en réponse à la demande du ministre voulant que le Ministère explique la façon dont l'aquaculture est gérée et dont l'approche de précaution est appliquée. Cela appuie un certain nombre d'attentes publiques de premier plan, y compris le rapport de la Commission Cohen, la lettre de mandat du ministre ainsi que le rapport publié par la commissaire à l'environnement et au développement durable au printemps 2018.

Il est important de mentionner que ce document est loin d'être définitif. Par exemple, pour que ce document soit équilibré à l'échelle nationale, nous souhaitons inclure à l'annexe 2 d'autres exemples d'application sur la côte est.

Avant de collaborer avec les provinces, les territoires et les peuples autochtones, nous désirons d'abord obtenir des commentaires à l'interne. Mardi, l'équipe de la Gestion de l'aquaculture a envoyé une version du document à ses directeurs régionaux afin d'obtenir leurs commentaires sur l'applicabilité du cadre à l'aquaculture, ainsi que des suggestions de modifications ou d'améliorations, le cas échéant.

Vous trouverez ci-joint la version la plus récente sur laquelle vous devez vous baser pour effectuer votre examen. Malheureusement, elle n'est disponible qu'en anglais pour le moment; vous recevrez la version traduite dès qu'elle sera prête.

L'équipe de la Gestion de l'aquaculture a demandé que les commentaires soient fournis d'ici le vendredi 12 octobre 2018. Les commentaires des Sciences des écosystèmes et des océans doivent donc aussi être soumis d'ici cette date.

Nous vous demandons de mobiliser, en plus de votre personnel d'aquaculture, la communauté scientifique de Pêches et Océans Canada (MPO) de votre région (le personnel scientifique des pêches et de l'habitat, etc.).

Veuillez envoyer vos commentaires, vos corrections et vos suggestions à Ingrid Burgetz et Jay Parsons, avec copie conforme à Wayne Moore, d'ici le 12 octobre. Ingrid et Ed Porter de l'équipe de la Gestion de l'aquaculture intégreront par la suite tous les commentaires reçus dans la prochaine version. De plus, on nous a demandé de convoquer une réunion d'examen technique du document avec des experts internes (scientifiques et gestionnaires) et externes. Nous vous contacterons bientôt pour des participants régionaux (Science de l'aquaculture des pêches ou de l'habitat). Ce sera également une approche supplémentaire ou alternative pour fournir une contribution régionale au document.

Par la suite, les prochaines étapes seront les suivantes :

- Le MPO finalisera le document aux fins de consultation externe et de présentation au ministre.

- Les équipes des sciences et de la direction du MPO effectueront un examen technique interne et externe du document (les détails seront fournis sous peu).
- Des consultations seront menées auprès des provinces et territoires par l'intermédiaire du Conseil canadien des ministres des pêches et de l'aquaculture.
- L'industrie sera consultée.
- Les peuples autochtones seront consultés.
- Le grand public sera consulté (par l'entremise du site Web du MPO).
- La version définitive du document sera affichée sur le site Web du MPO.

Je vous remercie grandement pour votre collaboration et votre soutien.

Je tiens à m'excuser pour les délais serrés, mais ce dossier est d'un grand intérêt pour le ministre.

Jay

On behalf of SRS and EOSS

Jay Parsons, PhD

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Application of the Precautionary Approach within a Risk Management Framework for Aquaculture

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Introduction

Globally, aquaculture continues to grow faster than other major food production sector, and has been identified by the FAO, as a critical contributor to food, nutrition and employment in the global economy.¹ The Government of Canada recognizes aquaculture's significant benefits to society, including providing full-time jobs in coastal Canada. In Canada, aquaculture is a relatively new industry and is jointly managed by the federal and provincial governments. There is tremendous potential for the Canadian industry to become an even greater player in overall world production. However, societal conflicts over which human activities are acceptable in Canadian waterbodies have created challenges to the growth and sustainability of aquaculture in Canada. This is often expressed as environmental sustainability concerns, ranging from direct environmental impacts to indirect impacts on wild fish health and productivity. A well-defined risk management framework, which embodies a clear understanding of unacceptable harm, taking precautionary steps where relevant and fully engaging the public throughout the entire risk-management process can help to clearly communicate where there are environmental risks, and can address both environmental sustainability issues and public concerns.

Fisheries and Oceans Canada's (DFO) mandate relates to the conservation of fish and fish habitat. This applies equally to fisheries as it does to decisions related to aquaculture. The starting point for any decisions made by DFO regarding human activities around waterbodies in Canada, including aquaculture, is founded on three key pieces of federal legislation: the *Fisheries Act*, the *Oceans Act* and the *Species at Risk Act*. Consequently, in executing the Department's fiduciary duty, the conservation of fish and fish habitat requires the conservation of biodiversity within the ecosystem, and the habitat and productivity of fish species. Given the complexity of detecting or monitoring biodiversity or productivity, proxies are used as practical measures for managing the environment. Therefore, the threshold for unacceptable harm to fish or fish habitat is any activity that has the potential to cause a population-level effect to fish species.

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In addition, there are international commitments and best practices that are relevant to the management of activities. The Rio Declaration of the UN Conference on Environment and Development (UNCED) supports the right of sovereign states to pursue responsible economic development opportunities as long as other member states or future generations are not negatively impacted by such developments. The notion of the Precautionary Approach (PA) is geared towards large-scale threats, especially when the consequences are serious or irreversible (e.g., climate change).

Many governments apply the precautionary principle as part of an overall risk management framework to activities that may not potentially result in large-scale or permanent environmental impacts, but may be activities that have societal concern. It is within this context, that DFO applies precaution as required in delivering its regulatory and legislative responsibilities for aquaculture.

¹ FAO - The State of World Fisheries and Aquaculture 2018

The following risk management framework for aquaculture is consistent with the overarching Sustainable Fisheries Framework. It also builds on the 2008 Aquaculture Policy Framework (APF) and specific policies developed to support DFO's B.C. Aquaculture Regulatory Program (BCARP).

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Moreover, this Framework is not meant to create any new legal obligations to apply precaution. DFO's role in regulating the aquaculture sector is fundamentally linked to and is consistent with the overarching Sustainable Fisheries Framework (SFF). The SFF provides the foundation for an ecosystem-based and precautionary approach to fisheries management in Canada, and provides the basis for ensuring Canadian fisheries are conducted in a manner which support conservation and sustainable use. Ultimately, through integration with the broader SFF, the residual effects of aquaculture on fish and fish habitat, following all mitigative actions, ensures that these effects can be taken into account in the sustainable management of fisheries.

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DFO'S Approach to Aquaculture Management

Aquaculture Management Objectives

The overarching departmental aquaculture management objective is to create the conditions for a successful and sustainable aquaculture industry across Canada. Within the overall objective, the department's goal for aquaculture is to ensure that fish and their habitats are protected using regulatory mitigation, monitoring and compliance approaches that are efficient, effective and aligned with the potential risk to the environment, and integrated (to the extent possible) with broader fisheries management approaches. Specifically, the **threshold for unacceptable harm to fish or fish habitat is any activity that has the potential to cause a population-level effect to fish species within the 'region or area' of aquaculture activity.** Recognizing that aquaculture is managed federally and by provincial and territorial governments, the department's overall assessment of risk will consider risk management and mitigation measures by all regulatory partners.

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Causing "a population-level effect to fish species" without specifying the spatial extent will be impossible to implement. For example, an important forage fish, shiner perch, are ubiquitous along the BC coast and so how would/could a population be defined? Same issue with habitat. The vast majority of marine species use multiple habitat types through their life history spread over various spatial extents (due in part to different life histories).

An Ecosystem and Precautionary Approach

Ecosystem approaches recognize that humans are part of, and have significant influences on, their environments. In aquaculture management under an ecosystem approach—as in fisheries management more broadly—regulatory decisions consider the impact of human activities on fish species, habitats, and the ecosystem of which these species are a part, and take into account broad ecosystem changes related to weather and climate. While it is recognized that all habitats, species, populations and communities play a role in aquatic ecosystems, some are more important from an ecological perspective and some are more resilient than others.²

DFO incorporates a precautionary approach within its ecosystem approach to fisheries

² Principles of Ecosystem Based Fisheries Management: <http://www.dfo-mpo.gc.ca/fm-gp/peches-fisheries/fish-ren-peche/sff-cpd/ecosys-back-fiche-eng.htm>.

management decision-making, supporting the economic use of resources while ensuring that potential risks to aquatic environments are managed to prevent harm to fish populations and habitat, and to limit other less serious harm to the extent feasible given available technology and costs. Management decisions are more cautious when scientific information is uncertain, unreliable or less complete.³

Commented [D5]: Is 'serious' still relevant within the new FA ?
And, is 'harm' defined?

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making ecosystem-level decisions ?

Implementing an Ecosystem Approach in Aquaculture

An efficiently and effectively applied ecosystem approach for managing aquaculture in Canada includes risk management that considers environmental impacts holistically to enable the evaluation of ecosystem level impacts. This integrated strategy is supported through a risk management framework. The holistic evaluation of impacts is supported by the use of the Pathways of Effects (PoE) model for aquaculture (see next section).

Taken as a whole, this approach is designed to support the consistent regulatory management of related aquaculture activities while identifying location, species or operational-specific factors that may influence the extent of the impact on the environment in a particular situation.

Aquaculture Environmental Risk Management

There are five major elements in the Department's approach to managing the environmental risks that may arise due to aquaculture activities (Figure 1, below).

- (1) Defining the environmental and ecosystem objectives for aquaculture activities in Canada: these objectives are defined within legislation, through intergovernmental and international agreements, and consideration of societal values;
- (2) Issue identification: these can be identified through the results of scientific research, monitoring of environmental changes, and/or through public engagement;
- (3) Risk assessment: the science-based characterization of the likelihood and consequence of an activity and assessment of the overall risk, based on the current state of knowledge, and, the identification of uncertainty;
- (4) Risk management: this includes the assessment of how to address uncertainties through applying precaution measures and options for regulatory measures (mitigation and compliance/effects monitoring), and management decisions on mitigation, monitoring, and licencing; and,
- (5) Monitoring and evaluation of the activity against the identified risks.

Throughout this process, communication and feedback are critical.

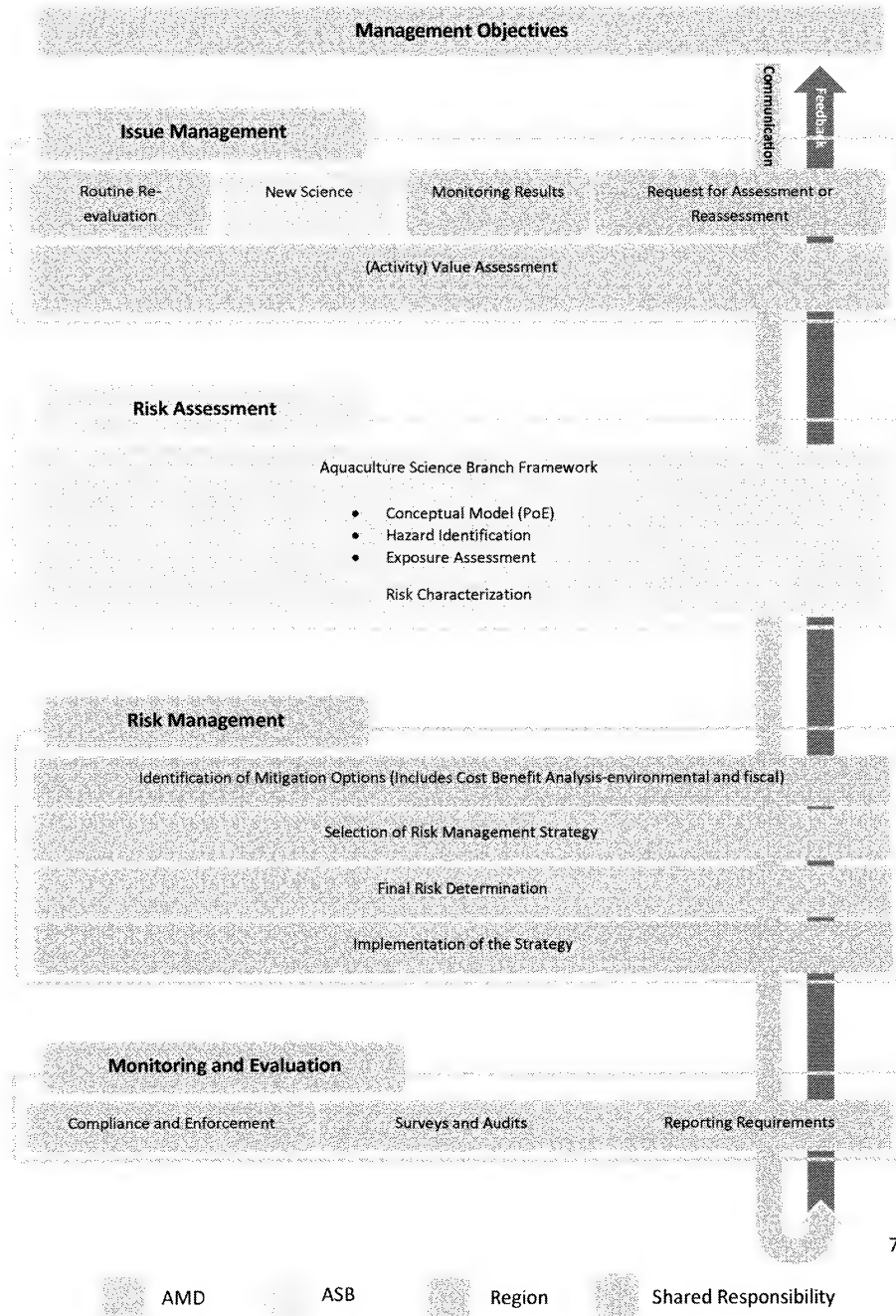
Integral to this process is that management decisions are based on many considerations, including, but not exclusively, scientific, social, economic and political. It is important to note that not all aquatic areas require equal levels of protection, as not all areas are equally ecologically or biologically significant or vulnerable.

³ A Fishery Decision-making Framework Incorporating the Precautionary Approach: <http://www.dfo-mpo.gc.ca/fm-gp/peches-fisheries/fish-ren-peche/sff-cpd/precaution-eng.htm>.

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Figure 1: Aquaculture Environmental Risk Management Framework



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Management decisions should also take it into consideration, as may be available, Indigenous Peoples traditional and ecological knowledge.

This approach supports management decision-making with respect to both (1) the setting of broad management (mitigation and monitoring) measures, such as siting criteria and general conditions on operations; and, (2) the consideration of individual applications (e.g., new or amended licences), focussing resources on risks that are unique to the proposed application.

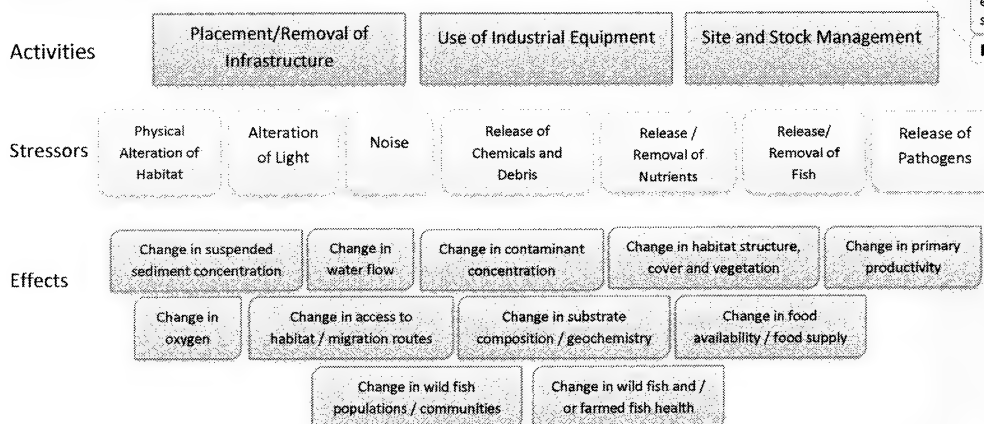
Pathways of Effects (PoE) Model

A Pathways of Effects (PoE) model is a tool that can convey complex interactions between human activities, the stress they can place on the environment (pressures), and environmental effects. The model operates on the premise that human activities can place stress on the environment which, in turn, can lead to various environmental effects. The model recognizes that a single environmental stressor can have multiple source activities and can lead to one or more environmental effects. It also recognizes that a single environmental effect can be influenced by one or more stressors or activities.

PoE diagrams group similar components together at each level in the model (activities, stressors and effects), noting inter-linkages in text descriptions of the environmental considerations. These diagrams and descriptions are designed to communicate information in a manner that facilitates the consideration of overall impacts on the environment, and the ecological benefits and costs of various potential management measures, including interactions between measures and cumulative impacts.

The scientific basis for links between aquaculture activities, stressors and effects was peer-reviewed through DFO's Canadian Science Advisory Secretariat process, and the summaries of the scientific state of knowledge for each of the stressors. This information is available for use in the evaluation of aquaculture activities and the identification of where management intervention may be required to protect fish and/or fish productivity/populations.

Figure 2: Pathways of Effects for Finfish and Shellfish Aquaculture



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At the specific aquaculture application level, the linkages between each of the stressors and the relevant effects are considered. The specific environment and activity will determine which stressor-effect linkages exist, and what mitigation measures can be used to effectively and sustainably break the stressor-effect linkages.

- Physical alterations to the habitat occurs when activities related to placing or removing physical infrastructure (e.g. net pens, longlines, rafts, anchors and moorings, shellfish beach culture structures), as well as during the use of husbandry equipment (e.g. underwater lights to increase growth in marine finfish or acoustic deterrent devices to discourage predators⁴).

The extent and impact of the predicted physical alterations to habitat are considered primarily during the pre-operational stage (e.g. site application), which includes an evaluation of the type of benthic habitat in the area being proposed for aquaculture.

- Release of chemicals and debris occurs primarily with activities associated with site and stock management, and the use of operational equipment where chemicals and debris may be released. Examples include the use of pesticides, drugs and antifouling agents, and the use of materials in construction (e.g. steel, wood, floatation) and operations (e.g. feed bags, ropes), which can be lost from sites as debris.

The effect of the use of pesticides, drugs and antifoulants on the receiving environment, including on non-target organisms, is assessed by Health Canada.

- Release of organic and related matter occurs as a result of stock management activities (e.g. the feeding and cultivation of fish, removal or natural sloughing of biofouling organisms from physical infrastructure) that have an organic or related component (e.g. nutrients).

The predicted extent of organic deposition on the surrounding seafloor is assessed at the pre-operational stage. As part of the on-going operational compliance, marine finfish aquaculture operations must meet a performance-based regulatory requirement related to the release of organic matter.

- Removal of nutrients and organic matter occurs as a result of stock management activities where some cultured species (e.g. bivalves) remove particulate matter, nutrients and oxygen from the water column.

The predicted extent of the removal of nutrients on wild populations is assessed at the pre-operational stage.

- Release or removal of fish occurs primarily as a result of stock management activities.

⁴ Note that the use of acoustic deterrent devices is not a current practice in Canadian aquaculture.

The removal of fish is considered and managed as bycatch. This occurs when some individual wild fish may be temporarily or permanently removed from waters along with cultured fish (e.g. during grading or at harvest), or as part of biofouling or predator control.

The addition of fish to the environment occurs either as a result of intentional stocking of cultured fish into aquatic environments for cultivation (e.g. salmon enhancement), or as a result of unintentional release of fish (e.g. escapes).

The impact on wild populations from the unintentional release of cultured organisms is considered at the pre-operational stage, and is also linked to fiduciary responsibilities associated with the *Species at Risk Act*.

- Release of pathogens and pests occurs associated with site and stock management. The increase in biomass of fish within an aquaculture site can influence the presence or abundance of fish pathogens (e.g. bacteria, viruses) and pests (e.g. sea lice and tunicates).

The introduction of pathogens or pests is evaluated at the operational stage, primarily by the Introductions and Transfers Committees (ITC). Conditions of licence outline mitigation measures for the management of the abundance of pathogens or pests. Additionally, notifiable diseases are regulated by the Canadian Food Inspection Agency.

Additional details on the characterization of each of the stressors, the current status of regulatory thresholds, and current management and mitigation practices are found in Annex 1. Also, a case study for the management of sea lice in B.C. is found in Annex 2.

Stakeholder and Indigenous Peoples' Engagement

Stakeholder and Indigenous peoples' engagement to support sound aquaculture governance is critical. The lack of social licence is a major barrier to robust aquaculture growth. Other factors, including the type of regulatory regime or site-specific development capacity characteristics, may play a role, but not to the extent of societal acceptance. The best mechanism for sustainable growth is via coastal zone and area-based management approaches which fully engage interested stakeholders and indigenous groups, who may actually contribute to decision-making. These processes not only support general agreement of where sites should go, but also the areas of greatest concern to focus on.

It should be recognized that some risks are new or emerging, and the evolution of scientific knowledge may influence society's tolerances and its chosen level of protection. An understanding of the "public's tolerance for risks" or "society's chosen level of protection" underpins the need for high transparency, clear accountability, and meaningful public involvement and communication.

Two-way sharing of information and the inclusion of a range of perspectives in the decision-making process can become the cornerstone of openness and transparency, and enhance credibility of and trust in the decisions that the Government develops.

Conclusion

DFO has managed aquaculture over the years based on managing environmental impacts and the potential risks these can pose to fish habitat and fish populations, as identified through the DFO peer-reviewed science process. Where relevant, DFO regulators strive to develop management standards or thresholds, which are informed by science, based on best practices globally, and have received some form of stakeholder and indigenous peoples' input.

Aquaculture management is a shared responsibility between the federal and provincial governments; thus, management frameworks need to be foundationally the same. In circumstances where there is a potential for unacceptable harm to fish (population-level effects), it may be appropriate to make decisions and implement precautionary measures in the near term, without having full certainty of the probability or magnitude of harm. Close monitoring would also occur to assess the effectiveness of the measures in addressing risk and overall impacts. Follow-up activities, including Research and monitoring, are key to reducing scientific uncertainty and allow improved decisions to be made in the future. Finally, stakeholder and Indigenous peoples' engagement throughout the risk management process is critical, not just at the final decision-making process.

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Annex 1: Details on Aquaculture Stressors, Effects and Risk Management

STRESSOR	THRESHOLD	MANAGEMENT ACTION / MITIGATION
<p>Release of pests and pathogens</p> <p>Pathogens can be endemic in wild fish populations (i.e., occur naturally in wild populations in a region) or exotic (i.e. occur naturally in other locations and have been introduced in a region). The presence of endemic pathogens can be amplified under some circumstances where fish are in close proximity (e.g. spawning grounds, schooling and aquaculture). Endemic pathogens tend to have a less severe effect on native populations than exotic (or introduced, non-endemic) pathogens, as over multiple generations native species have typically developed an immune response to endemic pathogens.</p> <p>The health status of wild fish often cannot be directly assessed, and changes in wild fish populations or communities due to disease are difficult to determine. Diseased and moribund fish are quickly removed from the population through processes such as predation or mortality; sampling can therefore be easily biased toward healthy individuals. The presence or absence of pathogens is particularly difficult to determine in wild fish populations, nor is there available scientific data to determine the effect of low level presence of pathogens at the individual or population level.</p>	<ul style="list-style-type: none"> Sea lice threshold (B.C. only); Mandatory Reporting of Fish Health Events (i.e., treatment or % loss) (B.C. only) 	<p>Conditions of licence require treatment for sea lice above threshold (3 lice/fish in B.C.)</p> <p>Monitoring fish health is a particularly important mitigation tool when cultured fish are destined for movement to another location or for release into aquatic environments. The determination of the appropriateness of planned movements or releases of fish must be based upon a review of the disease and mortality history of the cohort, on recommendations by a qualified fish health professional, on the results of any recommended pre-release disease screening, and on guidance from regulatory agencies.</p>
<p>Release (or removal) of organic matter and nutrients</p> <p>Potential sources of the release of other organic matter include fish carcasses (e.g. from cultured fish or bycatch⁵), feed spillage, faeces,</p>	<ul style="list-style-type: none"> BOD threshold 	<p>Footprint addressed through initial siting decisions (benthic impact depositional modeling)</p> <p>Performance based threshold (on-going assessment once/production cycle) – under the AAR, sites cannot be restocked</p>

⁵ The release of incidental finfish catch during finfish harvest, as may be required under conditions of licence, may contribute to organic matter in the environment if the fish are dead or have a low chance of survival.

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<p>harvest waste or offal, including blood. Release of organic matter into the marine environment from humans working and/or living on site could also constitute a minor contribution of organic matter to aquatic environments, should it occur. Human waste is generated on boats or in working or living accommodations as part of daily activities like cooking, bathing and bodily functions. The majority of organic matter introduced into the environment from finfish aquaculture will be associated with excess feed and faeces. Accumulation of the organic matter can result in a change in the benthic biodiversity around a site.</p>		<p>if sulphide threshold exceeded</p>
<p>Release of chemicals/drugs</p> <p>Pesticides are assessed by the Pest Management Regulatory Agency of Health Canada for value of use, human, animal and environmental risks under the <i>Pest Control Products Act</i>. Factors considered in environmental risk assessments related to pesticides include the potential transport and dispersal of products and/or their constituents following release into waters, as well as the exposure of non-target organisms to concentrations of substances that could result in lethal or sub-lethal (e.g. behavioural, reproductive) effects. The severity of impacts on exposed non-target species will depend on factors such as the toxicity of the product used, the dosage, the presence of susceptible non-target species / life stages of species, and environmental conditions.</p>	<ul style="list-style-type: none"> No thresholds – Research and analysis underway to provide advice on the design of a post-deposit monitoring program. 	<p>PRMA can place limits on the timing, location and volume of the release of specific materials.</p> <p>Under development – traffic light system for 1) pre-siting assessment to inform site placement, and 2) cumulative impacts [informed by post deposit monitoring program (site level) and aquaculture monitoring program (bay scale)]</p>
<p>Physical alteration of habitat</p> <p>The addition, removal, and</p>	<ul style="list-style-type: none"> Maximum shellfish aquaculture coverage of 7% per bay in some areas of Canada 	<p>Primarily addressed through initial siting considerations.</p> <p>In situations where wild fish may be</p>

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modification of physical structures may affect bottom sediments, benthic communities, pelagic communities, and hydrodynamics.		present only on a seasonal basis, or where habitat is used by a species during a particular period (e.g. during reproductive phases), measures to limit the duration, timing or extent of installation, harvest or site maintenance activities may be warranted.
<p>Release (or removal) of fish</p> <p>Farmed finfish, including salmon, may escape, usually due to equipment failure or human error. Equipment failure may be weather-related, caused by predator attacks or other events that stress the containment infrastructure. For there to be genetic intrusion, establishment of non-native populations, predation or competition, farmed fish must first be released into the wild through escape or the release of viable gametes.</p>	<ul style="list-style-type: none"> • Reporting of escapes may be required, depending on jurisdiction • No <i>direct</i> genetic impact risk on West Coast from Atlantic salmon farms 	<p>Addressed through conditions of licence and development of national containment standards (to be developed)</p> <p>Regulation of fish containment structures and use of triploid farmed fish would further lower the extent of direct genetic interaction.</p> <p>In the event that an unintentional release does occur, measures such as escape response plans may help to recover released fish., particularly where a significant risk of harmful interaction with wild populations has been identified.</p> <p>Escape reporting and analysis of the measures employed may be used to help assess the effectiveness of current mitigation measures and develop future facility or regulatory measures, as appropriate. Measures for recording and reporting cultured fish inventories as well as accurate records of introductions and transfers of licensed species support a broader understanding of the scope (estimated quantity, species and timing) of unintentional releases, and may form part of the management approach in mitigating their effects.</p> <p>In circumstances where a new species is being considered for rearing in an area for the first time, a specific environmental risk assessment is warranted to determine whether or not an Introductions and Transfers licence should be issued (see National Code on Introductions and Transfers LINK). The Code provides guidance that the I&T risk assessment should typically focus on incremental risk aspects that are particular to that species. Species identified as higher risk may have special regulatory conditions imposed on</p>

		<p>them to bring the risk to an acceptable level. Where risk outcome warrants, some species may not be authorized for culture. An I&T risk assessment may also be warranted where a species is native to the province but new to culture. In terms of risks related to release of fish, the assessment should start by focussing on the probability of the cultured gametes interacting with wild fish populations, and in the case of finfish, the potential for escaped fish to interact and compete with populations of the same or other species.</p>
<p>Noise</p> <p>Noise associated with aquaculture operations may be produced incidentally during the routine operation of equipment such as aerators, feeders, generators and power washers, and by vessels servicing aquaculture facilities. The effects of such noise are expected to be localized, short-term and likely insufficient to cause injury or permanent displacement to marine organisms.</p>	None	<p>Addressed through initial siting considerations and conditions of licence</p>
<p>Alteration in light</p> <p>Measurements of light penetration around net pens show that little visible light is found outside the pens, which suggests that the use of lights in aquaculture will have minimal and mainly local ecological effects.</p>	None	<p>Addressed through initial siting considerations and conditions of licence</p> <p><i>In B.C. is there still a requirement to report the use of lights?</i></p>

Annex 2: A Case Study- Management of Sea Lice in B.C.

1. Description of Stressor and Potential Impact – Sea Lice

Environmental

The release of pathogens or viruses from aquaculture facilities through site and stock management is a stressor described in the Canadian Science Advisory Secretariat (CSAS) research document “Pathways of Effects for Finfish and Shellfish Aquaculture” (PoE). The primary effect associated with this stressor, as described in the PoE, is a change in wild fish and/or farmed fish health. Additional sea lice specific science advice has also been provided, and this case study and analysis draws on this advice⁶.

Sea lice are endemic to the Pacific Coast and are found on several species of Pacific salmon and non-salmonid species. They are also present in other areas of the world where Atlantic salmon reside, such as Norway and Scotland. There are a number of sea lice species throughout the world that have a range of hosts and life cycle characteristics. The species of concern in B.C. from an aquaculture perspective is the *Lepeophtheirus salmonis* (Salmon louse); however, there is another species, *Caligus clemensi* (Herring louse) which can occasionally cause concern in aquaculture facilities. The sea lice life cycle includes numerous stages, such as: the free-floating Nauplius stage, infectious copepodid stage, attached chalimus stages, and finally the motile stages (pre-adults, adults).

Farmed Atlantic and Pacific salmon are stocked at the marine sites free of lice and infection occurs by exposure to passing adult wild salmon. This is known as “spillover.” The intensity of infestation on farmed salmon is based on a number of factors including the size of the wild salmon run, sea water temperature, salinity and the health of the farmed fish. Cultured Pacific salmon are less susceptible to sea lice infestation than Atlantic salmon. When infestation occurs at a farm the sea lice numbers may become internally amplified, which may result in “spillover” to wild salmon. Of particular concern is the effect this may have on juvenile salmon smolts which have recently entered the marine environment as they are most susceptible to sea lice. Wild salmon smolts out-migrate from their natal streams during the spring and early summer. A corresponding “out-migration window” with different requirements for management of lice levels is incorporated into the licence conditions. The out-migration window as currently defined runs from March 1st until June 30th annually.

Social

There is a high level of concern from a segment of the public, some First Nations and ENGOs, on

⁶ Assessment of Sea Lice Monitoring and Non-Chemical Measures, DFO 2014 [SAR 2014/006](#)

the impact aquaculture has on wild Pacific salmon, and more specifically belief that sea lice can significantly negatively impact wild salmon populations. Wild salmon populations can be highly variable and in some cases a low run in one year can be followed by record high numbers; this happens in areas both with and without aquaculture facilities on migratory routes. Conflicting opinion about the possible impact of high levels of sea lice has not given these groups, governments, the media or the Canadian public a level of comfort that the Department is properly managing the risk the aquaculture industry may pose to wild salmon.

2. Current Management and Mitigation – Sea Lice

The goal of the current management approach is to ensure that no disease or disease agent negatively impacts the protection and conservation of fish. Presently, risk related to sea lice is managed through licence conditions and the Fish Health auditing program.

Pre-Operational Management Approach

The Precautionary Approach is applied during the consideration of new sites, both from a site-specific and broader area perspective. This is also true for applications for increased production at an existing site. There is recognition of the potential risk of increased sea lice abundance and corresponding infection of out-migrating salmon from licenced facilities as a result of increased production. Assessments including the history of sea lice abundance levels at that farm and neighbouring farms in the general area include recommendations for mitigation measures, such as area-based management (e.g. coordinated and timing of stocking, fallowing and sea lice treatments), maintenance of single-year classes, practicing integrated pest management, and timing of stocking to reduce the need for sea lice treatments. Geographic elements considered during the assessment include hydro-connectivity between the proposed site and adjacent farms, and proximity to known salmon migration routes.

When siting new facilities, efforts are made to avoid the siting of new aquaculture facilities in areas which are known to be important wild fish migration routes, nurseries, sensitive habitats, or have other importance to wild fish populations or significant to First Nations. Ongoing science and research forms part of this consideration.

Current Operational Management Approach

The licence conditions include sea lice monitoring protocols as well as sea lice abundance thresholds that a licence holder cultivating Atlantic salmon must abide by. This threshold is set at an average of three motile (pre-adult and adult) lice (*Lepeophtheirus salmonis*) per fish. During the outmigration period, salmon farmers are required to maintain lice levels below the three motile lice threshold. Outside this period, they are not obligated to maintain this threshold, but must notify DFO when they exceed and develop a mitigation strategy for consideration by DFO officials. This system allows for lice control during the sensitive out-

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migration period, but does not require treatment outside this period, thereby reducing the use and potential development of resistance to various sea lice therapeutants. Sea lice sampling on farms is required every two weeks at minimum during the out-migration period, and DFO auditing of the reported numbers and sampling methodology occurs on 50% of all active farms during this time. For the remainder of the year, sampling by industry is only required once per month, but will increase to every two weeks if threshold levels are exceeded.

Mitigation

Companies are increasingly moving towards an area-based management approach where all smolts in a given area are the same year-class and, if treatments are required, they are coordinated between these sites. Treatments are ideally timed in coordination with returning adult wild fish so that all wild fish have left the area before treatment is initiated. This is to avoid reinfection and retreatment which can lead to resistance. Currently the primary sea lice treatment is the use of emamectin benzoate (SLICE), which is an in-feed parasiticide.

In some areas in B.C., SLICE resistance has emerged in recent years. Industry is rapidly developing alternative treatment modalities to curtail SLICE resistance, and prevent the development of wide-spread resistance in the sea lice population in B.C. This involves the rotational use of alternative treatment methods, such as novel in-feed parasiticides, hydrogen peroxide baths and/or mechanical sea lice removal (e.g. Hydrolicer). An alternate method of reducing absolute sea lice inventory is through harvesting, which typically would occur when fish are near harvest weight. This method is only effective if harvesting is done at a rate that reduces a farm's absolute sea lice inventory (as defined in the licence).

3. Scientific Certainty – Sea Lice

A large number of scientific studies have been conducted in recent years which have tried to determine what, if any, harm is posed to wild salmon by sea lice spillback from Atlantic salmon farms. No conclusive evidence has been found to suggest that sea lice originating from farms are causing harm to wild stocks on a wide scale. This has largely been accepted by stakeholders and opponents to the salmon farming industry. This indicates that the three motile threshold is sufficiently conservative to mitigate risk to wild salmon posed by sea lice originating from farms. In the rare instances where farms have not been able to control lice levels during the out-migration period (often as a result of SLICE resistance), lice levels are found to be higher on out-migrating salmon smolts. This indicates that lice management on farms is vitally important to prevent an undue lice burden on wild smolts.

4. Residual Risk and Application of the Precautionary Approach – Sea Lice

Environmental

A changing climate makes future lice mitigation more uncertain and challenging. In years with warmer water temperatures and increased salinity the management of lice becomes more difficult. This is likely to become more common as time progresses. Additionally, the emergence of SLICE resistance on B.C.'s coast has presented a significant challenge to industry for effective lice management. The adoption of additional treatment options by industry is very welcome and has demonstrated that lice levels should be able to be effectively controlled, despite a changing climate and without sole reliance on SLICE. Effective management is vital to ensure that wide-spread resistance to lice therapeutants does not occur as it has in other jurisdictions. Ongoing research into the genetic determinants of lice resistance, use of cleaner fish, alternative treatments and alternative cage designs/husbandry methods are all very promising, and should be encouraged and supported to allow proactive management by industry. Under the present management regime, the residual risk once operational is determined to be medium. Application of the Precautionary Approach requires that the Department utilize existing and potential new management measures to ensure that the risk stays within an acceptable range.

Context	Risk Attributes		
	High	Moderate	Low
	High		
	Moderate	X	
	Low		

Social

Based on the level of scientific certainty that sea lice are not causing harm to wild fish populations the level of concern raised by the public is expected to diminish over time. Due to the variable nature of salmon returns there may continue to be a perception that declines in salmon populations are related to sea lice impacts. As noted above, environmental residual risk exists based on changing climate conditions. It is incumbent on DFO to ensure a robust scientific program remains in place to better understand how the change in climate conditions is affecting sea lice, and their interaction with farmed and wild fish. If this scientific research along with changing management requirements (as necessary) is communicated to the public in a pro-active manner, social acceptance should increase.

Context	Risk Attributes		
		High	Moderate
	High		
	Moderate		X

5. Next Steps and Future Developments – Sea Lice

DFO conditions of licence relating to lice have been found to be vague, outdated and sometimes unenforceable. Some preliminary ideas on changes to the licence to allow better regulation, while also providing additional tools and guidance to industry, include:

- Consider moving to adult female-based threshold, rather than current motile threshold.
- Establishment of a farm-based, in addition to a fish-based (as currently used), sea lice threshold (For example, we assume 500 000 fish on farm, with three motiles = 1.5 million lice allowable on a single farm).
- Harvest would no longer be deemed an appropriate management action within the out-migration [would only be used to lower farm-based “absolute sea lice inventory” below farm-level threshold (as mentioned above) before entry into out-migration].
- Change licence condition of “active farm” away from number of pens stocked (more than 3), to absolute number of fish on site for a given time (e.g. active site could be defined as: more than 30 days have passed since the introduction of more than 50 000 fish to a sea site).
- Consideration be given to initiating mandatory sea lice reduction prior to March 1, which is the generic time when out-migration is recognized to start, as stated in licence conditions.
- Implement mandatory post in-feed lice treatment reporting to better monitor efficacy.
 - E.g. 25-30 days have passed since the completion of treatment with an in-feed parasiticide medication.
- Implement prohibition on use of lice chemical therapeutant for a time in response to resistance.
 - E.g. treatment failure could be defined as: “failure to achieve > 60% reduction in pre-treatment lice numbers at the 25-30 day post-treatment counts”.
- SLICE use would be prohibited at that site again during the calendar year.

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Moving forward the Department must continue to do scientific research on sea lice and its relationship to farmed and wild salmonids in order to develop a clearer understanding of the possible linkages between the two and the corresponding risk to cultured and wild fish. It should also be cognizant of, review related independent science (science which comes from sources outside of DFO), and react to key new findings by adjusting our research objectives. Operationally DFO must adapt to new science, making changes to present management approaches as necessary.

Although the risk posed by sea lice is considered low based on our present scientific understanding, a Precautionary Approach to the siting of new farms in the future could incorporate the potential of sea lice becoming a higher risk because of changing environmental conditions.

Over and above the current operational management approach it is recommended that a risk-based traffic light system be implemented that would be tied to some objective measure of sea lice abundance (e.g. number and severity of exceedances). This approach could amalgamate information from an individual farm or a number in a geographic area that have hydro-connectivity. It is well established that sites which have good overall fish health performance, including a low sea lice burden, are less likely to become susceptible to disease.

A green designation would indicate that historically a site has good sea lice management with rare incidences of threshold exceedance and low or negligible mortality indicating a low residual risk to wild salmon. The Department could consider increases in production at these sites. A yellow designation would indicate some recurrent sea lice threshold exceedances that are able to be managed on site without the risk of associated fish health issues and do not represent a notable threat to wild salmon. Increases in production would not be considered and additional management measures may be required. A red designation would indicate serious, significant or repeated sea lice exceedances that could potentially represent a notable threat to wild salmon. Drastic management measures could include reducing authorized production, a requirement to fallow for a significant time period, or cancellation of the licence.

At present there is a lack of flexibility in the licence conditions to require actions such as those outlined for farms designated red as the Department does not have the legislative authority. Moving forward the Department should pursue legislative/regulatory changes to obtain this authority.

APPENDIX I: Marine Finfish Pre-Operational Risk Table

There are a number of elements that are already assessed at the pre-operational application stage and the risks are summarized for senior management in a table.

Farm name:	Company:			
Elements Assessed – Wild Fish and Fish Habitat	Low	Med	High	N/A
Presence/use and interactions with CRA fishery or rare species				
Presence of important fish habitat (e.g. sponge reefs, rockfish nursery, etc.)				
Presence/use and interactions with SARA listed species				
Appropriate distance to salmonid-bearing streams				
Appropriate distance to important herring spawn areas				
Appropriate distance to shellfish beds				
Appropriate depth, currents and benthic substrate				
DEPOMOD predictions acceptable				
Existing seabed conditions (e.g. capable of assimilating waste)				
Historic benthic monitoring results				
Use of lights				
Marine mammal usage & mitigation				
Elements Assessed – Fish Health	Low	Med	High	N/A
Diseases of concern on farm, nearby farms, and in area (if known)				
History of appropriate disease management on farm and nearby farms				
Prudent history of medicant use (if known)				
Hydrological connectivity with other farms & co-management plan(s)				
History of compliance and reporting on FH and SL				
Adequacy of submitted FHM, SOPs and Carcass Management Plans				
Water quality (e.g. DO, water flow; if known) & mitigation				
Natural challenges (e.g. plankton issues, harmful algal blooms; if known) & mitigation				
Fish density appropriate to maintain good FH (if known)				
Species intended to be grown is appropriate for the area				
History of predator stress & mitigation (if known)				
Elements Assessed – Sea Lice	Low	Med	High	N/A
Natural occurrence of sea lice at site				
History of staying below sea lice thresholds during smolt out-migration				
Appropriate use of available tools to manage sea lice in future				
Elements Assessed – Existing Fisheries	Low	Med	High	N/A
CSSP closure on bivalve shellfish beds used in CRA fisheries				
First Nations FSC fisheries/site access				
Commercial fisheries (direct or indirect displacement – reduction in stock				
Recreational fisheries (direct or indirect displacement – reduction in stock				
EFA/test fishery/research area				
Geoduck beds				

Higgins, Mark

From: Higgins, Mark
Sent: September-28-18 9:37 AM
To: Lowe, Carmel
Subject: RE: URGENT INFORMAL: Sea Lice

There are hundreds of different copepod species, but the salmon louse is *Lepeophtherius salmonis* which causes the most damage on pacific salmon and as Simon refers to, is how the farms manage lice infestations. Over the course of this summer, there has been a proliferation of *Caligus clemensii* on the west coast of Vancouver Island, which is more usually common on back ground species like stickleback and bottom fish, and are not usually associated with damage to the skin of salmon.

So bullet should read:

- DFO's sea lice regulations currently focus on the salmon louse, *Lepeophtherius salmonis*, and include a management threshold of 3 lice per fish

Hope this clarifies.

Mark.

From: Lowe, Carmel
Sent: September-28-18 9:22 AM
To: Higgins, Mark
Subject: FW: URGENT INFORMAL: Sea Lice

See request below – can you provide a bullet that indicates – there are several species of sea lice ... with x,y,z being the most common...' or something similar to address the DMO question....?

Carmel

Carmel Lowe, Ph.D.
Regional Director Science | Directrice régionale des sciences
Fisheries and Oceans Canada | Pêches et Océans Canada
Pacific Biological Station | Station biologique du Pacifique
3190 Hammond Bay Rd, Nanaimo, BC, Canada V9T 6N7

Carmel.Lowe@dfo-mpo.gc.ca
Telephone | Téléphone 250-756-7177
Facsimile | Télécopieur 250-729-8360
Government of Canada | Gouvernement du Canada

From: Kaba, Kyle
Sent: September 28, 2018 8:50 AM
To: Lowe, Carmel <Carmel.Lowe@dfo-mpo.gc.ca>
Subject: RE: URGENT INFORMAL: Sea Lice

Hi Carmel,

Thanks again for the quick response to this. Quick follow up question from DMO. First bullet: What does Leps refer to? I'm assuming it's a certain type of species but can we be more explicit with the first bullet?

I noted Simon is out of office today so I'm reaching out to you. Thanks in advance!

Kyle

From: Lowe, Carmel
Sent: September-26-18 4:43 PM
To: Thomson, Andrew
Cc: Kaba, Kyle
Subject: FW: URGENT INFORMAL: Sea Lice

Info from Simon below..... let me know if we can provide anything additional.

Carmel

Carmel Lowe, Ph.D.
Regional Director Science | Directrice régionale des sciences
Fisheries and Oceans Canada | Pêches et Océans Canada
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Government of Canada | Gouvernement du Canada

From: Jones, Simon
Sent: September 26, 2018 4:17 PM
To: Lowe, Carmel <Carmel.Lowe@dfo-mpo.gc.ca>
Cc: Higgins, Mark <Mark.Higgins@dfo-mpo.gc.ca>
Subject: RE: URGENT INFORMAL: Sea Lice

Carmel, Mark,

I have reorganized the material to bring the more relevant points to the fore:

Related to the Ha-Shilth-Sa article:

- DFO's sea lice regulations focus only on Leps and include a management threshold of 3 lice per fish.
- Prior to closure of the site there was an infestation with another sea lice species, "Caligus".
- The Caligus infestation was sufficiently severe to cause a fish welfare concern and trigger a SLICE treatment.
- Although the SLICE treatment was successful, the farm was closed [REDACTED]
- Persistent, high levels of Caligus are rare on farmed fish; as are welfare concerns caused by this parasite.
- Caligus is a common parasite of herring and stickleback in coastal BC.

Here are DFO's most recent approved media lines relating to sea lice/salmon farming in Clayoquot.

Media lines:

s.20(1)(b)

- Fisheries and Oceans Canada (DFO) is confident in the monitoring being done in the Clayoquot area by environmental non-government groups, and third party environmental consultants hired by Cermaq. For this reason, DFO determined that resources could be better directed to furthering research into SLICE resistance (SLICE is approved for use in Canada as an in-feed therapeutant used by the salmon aquaculture industry to manage sea lice. It can only be administered to farmed fish under veterinary prescription).
- DFO is keeping a close eye on the issue of SLICE resistance. The Department collected sea lice from Cermaq Canada's Bawden site in the Clayoquot area and sent them to the BC Centre for Aquatic Health Sciences for analysis, which confirmed SLICE resistance. Those lice were later sent to researchers at the Atlantic Veterinary College who are undertaking work to better understand the genetic basis for SLICE resistance.
- During most years, more than 90% of sites in BC are below the regulatory thresholds for sea lice during the wild salmon outmigration period (from March 1 to June 30 of each year) However, there were documented failures of SLICE treatment at Klemtu in 2015 and Esperanza Inlet in 2017 and now Clayoquot Sound in 2018.
- Research is under way, by DFO, industry, and academia, to find alternative methods to manage sea lice, and to better predict and track SLICE resistance For instance, DFO is currently studying, or supporting research on, the use of Pacific perch as "cleaner fish" that eat sea lice off farmed fish and warm water baths to kill sea lice. More information on these projects can be found at www.dfo-mpo.gc.ca/aquaculture/sci-res/rd-eng.htm
- DFO is also supporting the licensing and approval process for alternative sea lice treatments, which are a necessary part of an integrated pest management approach.

Please let me know if these require refinement.

Simon

From: Lowe, Carmel
Sent: September-26-18 2:29 PM
To: Higgins, Mark; Jones, Simon
Subject: Fw: URGENT INFORMAL: Sea Lice

See request below.....

Simon - can you develop some bullets to feed into this?

Carmel

Sent from my BlackBerry 10 smartphone on the Rogers network.

From: Kaba, Kyle <Kyle.Kaba@dfo-mpo.gc.ca>
Sent: Wednesday, September 26, 2018 14:17
To: Thomson, Andrew; Lowe, Carmel
Subject: FW: URGENT INFORMAL: Sea Lice

Hi Andy/Carmel – We've received an urgent request from MINO on information (that could be shared with the Province) concerning the article linked below. Article is regarding high sea lice counts leading to Cermaq closing farm sites in Clayoquot Sound.

Can you please have a look and provide a few bullets that can be shared with MINO (for sharing with the Province). MINO has requested info as soon as possible. Would it be possible to have something by tomorrow at noon PST? Please let me know.

Thanks in advance and sorry for the short turn around.

Kyle

From: Butcher, Ashley
Sent: September-26-18 1:42 PM
To: Kaba, Kyle
Cc: Jarjour, Jasmine; Hirani, Samia; Khwaja, Saba; Kahn, Zoe; Barker, Tyler; Villeneuve, Anne-Marie
Subject: Re: URGENT INFORMAL: Sea Lice

Hey Kyle - over to you!

From: Richter, Julie
Sent: Wednesday, September 26, 2018 4:32 PM
To: Butcher, Ashley; White, Andrea
Cc: Jarjour, Jasmine; Hirani, Samia; Khwaja, Saba; Kahn, Zoe; Barker, Tyler; Villeneuve, Anne-Marie
Subject: RE: URGENT INFORMAL: Sea Lice

Hi Ashley – Pacific Region would be best placed to respond.
Julie

From: Butcher, Ashley
Sent: September-26-18 4:22 PM
To: White, Andrea; Richter, Julie; Villeneuve, Anne-Marie
Cc: Jarjour, Jasmine; Hirani, Samia; Khwaja, Saba; Kahn, Zoe; Barker, Tyler
Subject: URGENT INFORMAL: Sea Lice

Hey there - not sure who to direct this to. MINO urgently looking for information that could be shared with the province concerning the attached:

<https://hashilthsa.com/news/2018-09-17/high-sea-lice-counts-leads-cermaq-close-farm-site-clayoquot-sound>

Thanks,

Ashley

Higgins, Mark

From: Higgins, Mark
Sent: October-10-18 4.11 PM
To: Parsons, Jay
Cc: MacDougall, Lesley; Lowe, Carmel
Subject: RE: Aquaculture Risk Management Framework and the Application of the Precautionary Approach
Attachments: Application of the Precautionary Approach_merged_doc.docx; Pacific region Comment Precautionary.docx

Hello Jay, Pacific Region distributed this document broadly soliciting input and comments. Please find attached both the document with suggested changes and comments that you sent, along with written comments from those who preferred to provide separately. I am hoping this will help to narrow the scope of the document and help you in refining the content to your desired audience. If you would like to talk further, please contact me.

Mark Higgins

A/Division Manager ADGT
Fisheries and Oceans Canada / Pêches et Océans Canada
Pacific Biological Station / Station Biologique du Pacifique
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From: Parsons, Jay
Sent: September-19-18 11:48 AM
To: McCallum, Barry; Vézina, Alain; Bliss, Doug; de Lafontaine, Yves; Wang, Sen; Lowe, Carmel; Laverdure, Louise
Cc: McPherson, Arran; Moore, Wayne; Burgetz, Ingrid; Davis, Ben; Meade, James; Sullivan, Mike DJ; Blair, Tammy; Cooper, Lara; Paul, Stacey D; MacKinnon, Anne-Margaret; Ouellette, Marc; Pomerleau, Corinne; Mckindsey, Chris; Christie, Gavin C; Geiling, Doug; Kennedy, Eddy; Higgins, Mark; White, Andrea; Pilcher, Scott
Subject: Aquaculture Risk Management Framework and the Application of the Precautionary Approach
Importance: High

Le français suit

Colleagues,

As mentioned Monday, a draft Aquaculture Risk Management Framework/Application of the Precautionary Approach has recently been developed, in response to the Minister's request that the Department explain how aquaculture is

managed and how the precautionary approach is applied. This supports a number of high profile and public expectations, including the Cohen Commission report, the Minister's mandate letter and the Spring 2018 report from the Commissioner for the Environment and Sustainable Development.

It is important to note that this document is very much still a work in progress. For example, the intention is to balance this document nationally by including additional examples in Annex 2 incorporating east coast applications.

Prior to engaging with the Provinces, Territories and Indigenous Peoples, comments and feedback internally is being sought. Aquaculture Management sent out a version Tuesday to their RDs seeking their comments on the applicability of the framework to aquaculture, and changes and/or improvements.

The attached version is the most recent and current version and should be used for the purpose of review. Unfortunately, it is currently only available in English; the translated version will be sent when it becomes available.

Aquaculture Management has requested feedback by **Friday October 12, 2018**. Therefore, the comments from EOS will also need to be submitted by that time as well.

We ask that you broadly engage the DFO Science community within your region (i.e., in addition to aquaculture staff, also fisheries science and habitat science staff, etc.).

Please send your collated comments, corrections and suggestions to Ingrid Burgetz and Jay Parsons, with a cc to Wayne Moore by October 12th. Ingrid and Ed Porter from Aquaculture Management will then integrate all the comments into the next version. As well, we have been asked to convene a departmental technical review meeting of the document with internal (Science and Management) and external experts. We will soon be approaching you for suggested regional participants (Aquaculture / Fisheries / Habitat Science). This will also be an additional or alternate approach to providing regional input into the document.

Next steps following this include:

- DFO finalization of the document for external consultation, including presentation to the Minister
- DFO Science & Management internal and external technical review (details to be shared shortly)
- Consultations with P/T through the Canadian Council of Fisheries and Aquaculture Ministers
- Industry consultation
- Indigenous consultations
- Public consultation (on DFO website)
- Final posting on DFO's website

Thank you very much to your collaboration and support.

I apologize for the tight timelines, but this file has the express interest of the Minister.

Chers collègues,

Comme mentionné lundi, une ébauche du cadre de gestion des risques liés à l'aquaculture et de l'application de l'approche de précaution a récemment été élaborée en réponse à la demande du ministre voulant que le Ministère explique la façon dont l'aquaculture est gérée et dont l'approche de précaution est appliquée. Cela appuie un certain nombre d'attentes publiques de premier plan, y compris le rapport de la Commission Cohen, la lettre de mandat du ministre ainsi que le rapport publié par la commissaire à l'environnement et au développement durable au printemps 2018.

Il est important de mentionner que ce document est loin d'être définitif. Par exemple, pour que ce document soit équilibré à l'échelle nationale, nous souhaitons inclure à l'annexe 2 d'autres exemples d'application sur la côte est.

Avant de collaborer avec les provinces, les territoires et les peuples autochtones, nous désirons d'abord obtenir des commentaires à l'interne. Mardi, l'équipe de la Gestion de l'aquaculture a envoyé une version du document à ses directeurs régionaux afin d'obtenir leurs commentaires sur l'applicabilité du cadre à l'aquaculture, ainsi que des suggestions de modifications ou d'améliorations, le cas échéant.

Vous trouverez ci-joint la version la plus récente sur laquelle vous devez vous baser pour effectuer votre examen. Malheureusement, elle n'est disponible qu'en anglais pour le moment; vous recevrez la version traduite dès qu'elle sera prête.

L'équipe de la Gestion de l'aquaculture a demandé que les commentaires soient fournis d'ici le vendredi 12 octobre 2018. Les commentaires des Sciences des écosystèmes et des océans doivent donc aussi être soumis d'ici cette date.

Nous vous demandons de mobiliser, en plus de votre personnel d'aquaculture, la communauté scientifique de Pêches et Océans Canada (MPO) de votre région (le personnel scientifique des pêches et de l'habitat, etc.).

Veuillez envoyer vos commentaires, vos corrections et vos suggestions à Ingrid Burgetz et Jay Parsons, avec copie conforme à Wayne Moore, d'ici le 12 octobre. Ingrid et Ed Porter de l'équipe de la Gestion de l'aquaculture intégreront par la suite tous les commentaires reçus dans la prochaine version. De plus, on nous a demandé de convoquer une réunion d'examen technique du document avec des experts internes (scientifiques et gestionnaires) et externes. Nous vous contacterons bientôt pour des participants régionaux (Science de l'aquaculture des pêches ou de l'habitat). Ce sera également une approche supplémentaire ou alternative pour fournir une contribution régionale au document.

Par la suite, les prochaines étapes seront les suivantes :

- Le MPO finalisera le document aux fins de consultation externe et de présentation au ministre.
- Les équipes des sciences et de la direction du MPO effectueront un examen technique interne et externe du document (les détails seront fournis sous peu).
- Des consultations seront menées auprès des provinces et territoires par l'intermédiaire du Conseil canadien des ministres des pêches et de l'aquaculture.
- L'industrie sera consultée.
- Les peuples autochtones seront consultés.
- Le grand public sera consulté (par l'entremise du site Web du MPO).
- La version définitive du document sera affichée sur le site Web du MPO.

Je vous remercie grandement pour votre collaboration et votre soutien.

Je tiens à m'excuser pour les délais serrés, mais ce dossier est d'un grand intérêt pour le ministre.

Jay

On behalf of SRS and EOSS

Jay Parsons, PhD

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Application of the Precautionary Approach within a Risk Management Framework for Aquaculture

Comment [TT1]: Overall it is unclear who the intended audience is for this. It seems too detailed for a strategic document but too few details are provided to make it a document that would stand alone for practitioners to use.

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Introduction

Globally, aquaculture continues to grow faster than any other major food production ~~sector~~~~sectors~~~~sector~~~~sectors~~, and has been identified by the Food and Agriculture Organization of the United Nations (FAO), as a critical contributor to food, nutrition and employment in the global economy.¹ The Government of Canada recognizes aquaculture's the significant benefits of aquaculture to society, including providing full-time jobs in coastal ~~Canada~~~~communities~~~~Canada~~. In Canada, aquaculture is a relatively new industry and is jointly managed by the federal and provincial governments.

There is tremendous potential for the Canadian aquaculture industry to become an even greater player in overall world production. However, societal conflicts over which human activities are acceptable in Canadian waterbodies have created challenges to the growth and sustainability of aquaculture in Canada. ~~These is are~~ This is often expressed as environmental sustainability concerns, ranging from direct environmental impacts to indirect impacts on wild fish health and productivity. A well-defined risk management framework, which embodies a clear understanding of unacceptable potential harm, taking precautionary steps where relevant and fully engaging the public throughout the entire risk-management process, can help to clearly communicate where there are environmental risks, and can address both environmental sustainability issues and public concerns.

Fisheries and Oceans Canada's (DFO) mandate relates to the conservation of fish and fish habitat ~~and~~ ~~This applies equally to both fisheries as it does to decisions related to and~~ aquaculture. The starting point for any decisions made by DFO regarding human activities around waterbodies in Canada, including aquaculture, is founded on three key pieces of federal legislation: the *Fisheries Act*, the *Oceans Act* and the *Species at Risk Act*. Consequently, in executing the Department's fiduciary duty, the conservation of fish and fish habitat requires the conservation of biodiversity within the ecosystem, and the habitat and productivity of fish species. Given the complexity of ~~detecting or monitoring~~ changes in biodiversity or productivity, proxies often are used as practical measures for managing the environment. Therefore, the threshold for unacceptable harm to fish or fish habitat is any activity that has the potential to cause a population-level effect to fish species.

~~In addition~~ Also, there are international commitments and best practices that are relevant to the management of human activities. The 1992 Rio Declaration of the UN Conference on Environment and Development (UNCED) supports the right of sovereign states to pursue responsible economic development opportunities as long as other member states or future generations are not negatively impacted by such developments. The notion of the Precautionary Approach (PA) is geared towards large-scale threats, especially when the consequences are serious or irreversible (e.g., climate change).

Many governments apply the precautionary principle as part of an overall risk management framework to activities that may not potentially result in large-scale or permanent

Comment [TT2]: What about the Territories ?

Comment [D3]: There are also concerns expressed about impacts on the economic value of capture fisheries for wild fish (e.g. sablefish, halibut).

Comment [TT4]: This should not be defined here. The framework should identify the risk/harm which is characterized later.

Comment [D5]: assessing

Comment [D6]: manage the environment or human activities?

Comment [D7]: Potential may need to be qualified further. Groups external to DFO often interpret this to be synonymous with possible. If this is how it continues to be framed it is extremely open ended i.e. although it's possible that pigs might fly, it's highly unlikely" which is the type of position we're often attempting to stake out. It would be more readily defensible to talk about activities that are likely versus unlikely to cause a population level effect to fish. This is clearly where the text intends to go in sections below that identify DFO's use of risk assessment and risk management as part of an integrated approach to ensuring capture and culture fisheries, ecosystems, habitats are managed to be sustainable.

Comment [TT8]: It is conceivable that almost any activity ... [1]

Comment [D9]: see my comments below

Comment [TC10]: This statement does not follow logically from the previous statement. Why would using proxies ... [3]

Comment [TT11]: Not sure how we actually got to this conclusion here. ... [2]

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Comment [TC12]: Which activities? Aquaculture activities? Marine activ ... [5]

Comment [TT13]: Clearly there are many of these with varying degrees ... [4]

Comment [TT14]: Expand ?

Comment [TC15]: This term needs a definition.

Comment [TT16]: Again, seems some linkage is required here for context.

Comment [TC17]: Use consistent language - either Precautionary Approach or Precautionary Principle.

Comment [D18]: Again, the notion of permanent requires further definition. If one defines this in terms of human l ... [6]

¹ FAO - The State of World Fisheries and Aquaculture 2018

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environmental impacts, but may be activities that have societal concern. It is within this context, that DFO applies precaution as required in delivering its regulatory and legislative responsibilities for aquaculture.

The following risk management framework for aquaculture is consistent with the overarching Sustainable Fisheries Framework (SFF). It also builds on the 2008 Aquaculture Policy Framework (APF) and specific policies developed to support DFO's B.C. Aquaculture Regulatory Program (BCARP).

Moreover, this Framework is not meant to create any new legal obligations to apply precaution. DFO's role in regulating the aquaculture sector is fundamentally linked to, and is consistent with, the overarching Sustainable Fisheries Framework (SFF). The SFF provides the foundation for an ecosystem-based and precautionary approach to fisheries management in Canada, and provides the basis for ensuring Canadian fisheries are conducted in a manner which supports conservation and sustainable use. Ultimately, through integration with the broader SFF, the residual effects of aquaculture on fish and fish habitat, following all mitigative actions, ensures that these effects can be taken into account in the sustainable management of fisheries.

DFO'S Approach to Aquaculture Management

Aquaculture Management Objectives

The overarching departmental aquaculture management objective is to create the conditions for a successful and sustainable aquaculture industry across Canada. Within the overall objective, the department's goal for aquaculture is to ensure that fish and their habitats are protected using regulatory mitigation, monitoring and compliance approaches that are efficient, effective and aligned with the potential risk to the environment, and integrated (to the extent possible) with broader fisheries management approaches. Specifically, the threshold for unacceptable harm to fish or fish habitat is any activity that has the potential to cause a population-level effect to fish species within the 'region or area' of aquaculture activity... Recognizing that aquaculture is managed federally and by provincial and territorial governments, the department's overall assessment of risk will consider risk management and mitigation measures by all regulatory partners.

An Ecosystem and Precautionary Approach

Ecosystem approaches recognize that humans are part of, and have significant influences on, their environments. In aquaculture management under an ecosystem approach—as in fisheries

Comment [TT19]: The reverse is also true but not noted but perhaps more problematic is that both scale and duration (i.e., permanent) are not well defined here or elsewhere in the document. For example, is large-scale a bay, a part of a bay, or the entire ocean? Similarly is permanent measured in a government's term, a human generation or geological time?

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Comment [TC20]: Maybe use the word "managed" instead?

Comment [TC21]: This sentence does not make sense - it is missing a subject. What ensures the effects can be taken into account? The framework? The precautionary approach? And what is going on with the residual effects?

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Comment [D22]: Is this defined in FA legislation or adhoc

Causing "a population-level effect to fish species" without specifying the spatial extent will be impossible to implement. For example, an important forage fish, shiner perch, are ubiquitous along the BC coast and so how would/could a population be defined? Same issue with habitat. The vast majority of marine species use multiple habitat types through their life history spread over various spatial extents (due in part to different life histories).

Comment [TT23]: As above, it seems this wording should be scoped more.

Comment [TT24]: How consistent is this with the SARA concept of acceptable harm? Is it simply the opposite wording?

Comment [TT25]: In some places it is Fed/Prov but here territories are included. Seems this should at least be consistent within the document.

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management more broadly—regulatory decisions consider the impact of human activities on fish species, habitats, and the ecosystem of which these species are a part, and take into account broad ecosystem changes related to weather and climate. While it is recognized that all habitats, species, populations and communities play a role in aquatic ecosystems, some are more important from an ecological perspective and some are more resilient than others.²

DFO incorporates a precautionary approach within its ecosystem approach to fisheries management decision-making, supporting the economic use of resources while ensuring that potential risks to aquatic environments are managed to prevent/minimize harm to fish populations and habitat, and to limit other less serious harm to the extent feasible given available technology and costs. Management decisions often are more cautious when scientific information is uncertain, unreliable or less complete.³

Implementing an Ecosystem Approach in Aquaculture

An efficiently and effectively applied ecosystem approach for managing aquaculture in Canada includes risk management that considers potential environmental impacts holistically to enable the evaluation of ecosystem level impacts. This integrated strategy is supported through a risk management framework. The holistic evaluation of impacts is supported by the use of the Pathways of Effects (PoE) model for aquaculture (see next following section).

Taken as a whole, this approach is designed to support the consistent regulatory management of related aquaculture activities while identifying location, species or operational-specific factors that may influence the extent of the impact on the environment in a particular situation.

Aquaculture Environmental Risk Management

There are five major elements in the Department's approach to managing the environmental risks that may arise due to aquaculture activities (Figure 1, below).

- (1) Defining the environmental and ecosystem objectives for aquaculture activities in Canada: these objectives are defined within legislation, through intergovernmental and international agreements, and consideration of societal values;
- (2) Issue identification: these can be identified through the results of scientific research, monitoring of environmental changes, and/or through public engagement;

² Principles of Ecosystem Based Fisheries Management: <http://www.dfo-mpo.gc.ca/fm-gp/peches-fisheries/fish-ren-peche/sff-cpd/ecosys-back-fiche-eng.htm>.

³ A Fishery Decision-making Framework Incorporating the Precautionary Approach: <http://www.dfo-mpo.gc.ca/fm-gp/peches-fisheries/fish-ren-peche/sff-cpd/precaution-eng.htm>.

Comment [TT26]: Consider linking explicitly to EBSAs and/or ESSs. Maybe some examples?

Comment [TT27]: Can't actually prevent in this case.

Comment [D28]: Is 'serious' still relevant within the new FA? And, is 'harm' defined?

Comment [D29]: Does cost feasibility really come into play making ecosystem-level decisions?

Comment [TT30]: Not clear how a multi-stage approach to harm is being defined/used here. What does less serious look like?

Comment [TT31]: Isn't this precautionary? It seems cautious and precautionary shouldn't be used interchangeably as they are different.

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Comment [TT32]: Wouldn't this framework also allow consideration of other levels? This could be quite useful if there is a specific sub-ecosystem level impact managers were trying to avoid.

Comment [TT33]: But there are other potential approaches that could be used. Is DFO committed to PoE even though these are very resource intensive and some situations might allow alternative approaches to be used? Are PoE libraries complete for aquaculture? Perhaps more problematic is the fact that risk determination is not clearly articulated outside of PoE (which are not a risk assessment tool).

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Comment [TT34]: Assume this includes spatial extent, temporal duration and some measure of magnitude/persistence?

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Comment [TT35]: I can see that the overarching objectives would be National but in this context (including Fig 1) isn't there scope for this applying to specific activities in specific locations. This would be more consistent with the typical scoping phase that would be next.

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- (3) Risk assessment: the science-based characterization of the likelihood and consequence of an activity impact and assessment of the overall risk, based on the current state of knowledge, and, the identification of uncertainty;
- (4) Risk management: this includes the assessment of how to address uncertainties identified risks through applying precautionary regulatory and precautionary measures and options for regulatory measures (mitigation and compliance/effects monitoring), and management decisions on mitigation, monitoring, and licencing; and,
- (5) Monitoring and evaluation of the activity against the identified risks, and management actions.

Throughout this process, communication and feedback are critical.

Integral to this process is that management decisions are based on many considerations, including, but not exclusively, scientific, social, economic, cultural and political. It is important to note that not all aquatic areas require equal levels of protection, as not all areas are equally ecologically or biologically significant or vulnerable.

Comment [D36]: As noted earlier, it would be advantageous to link items 3 and 4 here explicitly to statements about "potential to induce population level harm" above.

Comment [TC37]: The evaluation is not on the activity itself, but on the potential impacts of that activity (ie. we are not assessing the likelihood of fish farming, we are assessing the likelihood of wild salmon being impacted by the fish farming).

Comment [TT38]: To me this is much more than just dealing with the uncertainties.

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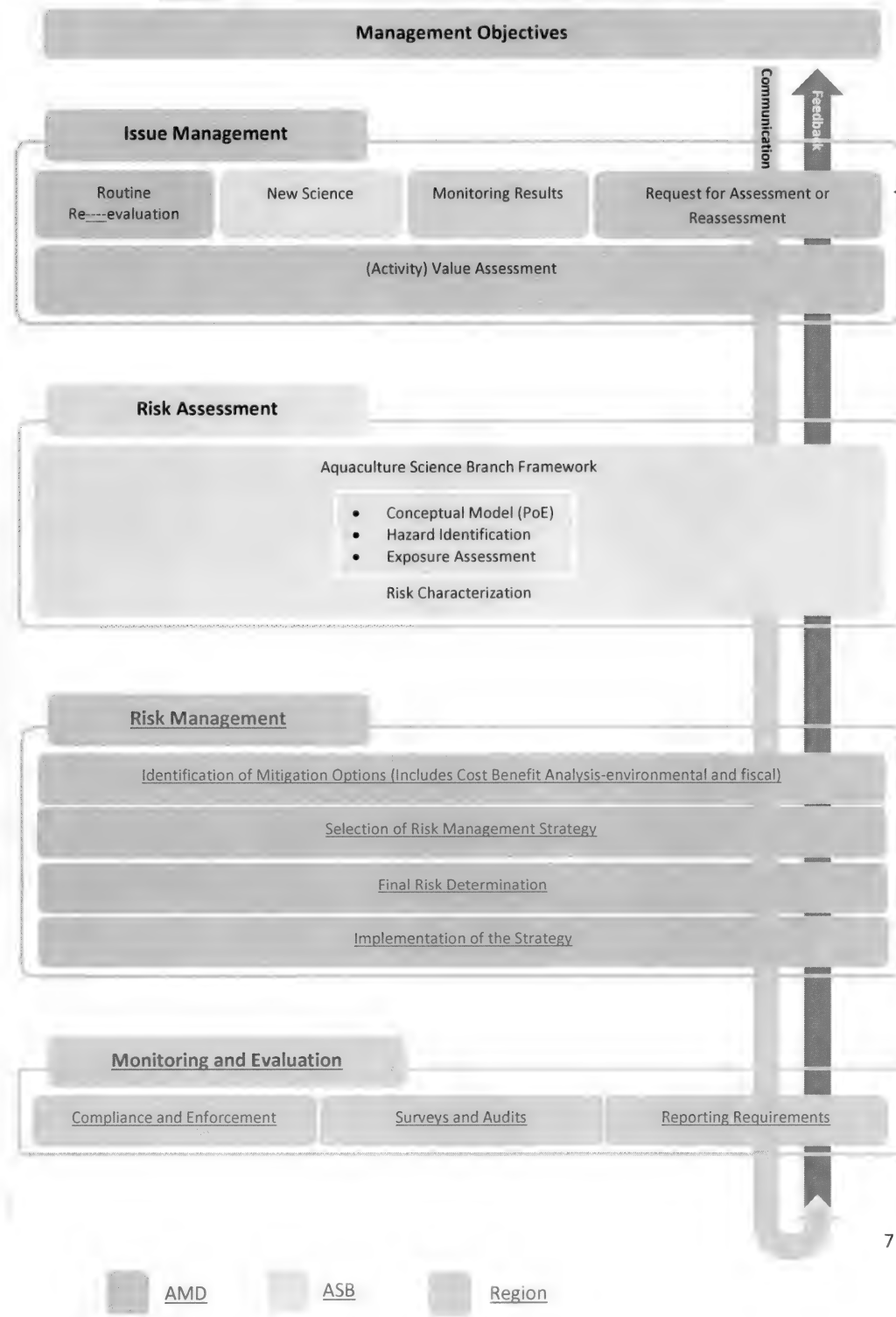
Comment [TC39]: Communication with who? Feedback from who? The industry? The public? The scientists?

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Comment [TT40]: Agree this needs to be highlighted but also important to note somewhere that the risk of the aquaculture activity is evaluated for each area specifically. This hasn't really been explicit in the document to this point.

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Figure 1: Aquaculture Environmental Risk Management Framework



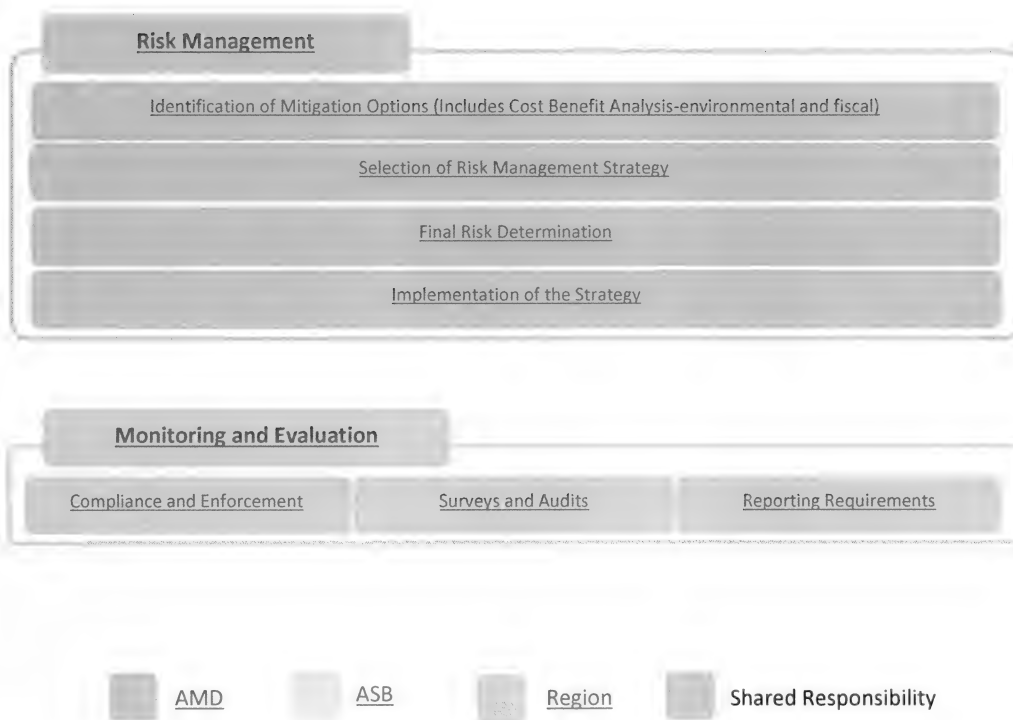
Comment [TT41]: I get the idea of the communication/feedback arrows but despite potential cluttering of the diagram there are important loops within each of these elements as well.

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Comment [D42]: Formal risk assessments require assessment of exposure and impacts (outcomes). I don't see this included here unless it's implicit in the PoE element.

Comment [TC43]: Define AMD and ASB

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Management decisions should also take it into consideration, as may be available, Indigenous Peoples traditional and ecological knowledge.

This approach supports management decision-making with respect to both (1) the setting of broad management (mitigation and monitoring) measures, such as siting criteria and general conditions on operations; and, (2) the consideration of individual applications (e.g., new or amended licences), focussinglicenceslicenses, focussingfocusing resources on risks that are unique to the proposed application.

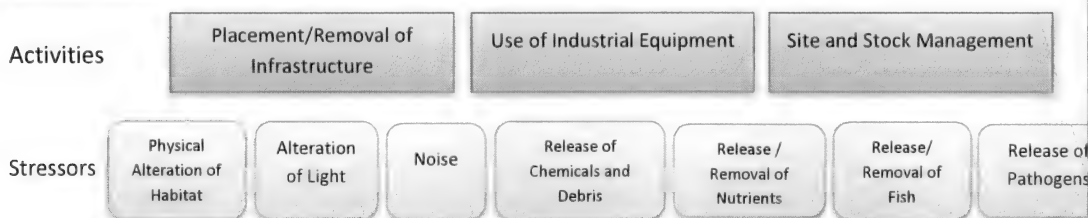
Pathways of Effects (PoE) Model

A Pathways of Effects (PoE) model is a tool that can conveyconvey complex interactions between human activities, the stress they can place on the environment (pressures), and environmental effects or impacts. The model operates on the premise that human activities can place stress on the environment which, in turn, can lead to various environmental effects. The model recognizes that a single source activity can result in one or more environmental stressor and that these environmental stressors can have multiple source activities and can lead to one or more environmental effects. It also recognizes that a single environmental effect can be influenced by one or more stressors or activities.

PoE diagrams group similar components together at each level in the model (activities, stressors and effects), noting inter-linkages in text descriptions of the environmental considerations. These diagrams and descriptions are designed to communicate information in a manner that facilitates the consideration of overall impacts on the environment, and the ecological benefits and costs of various potential management measures, including interactions between measures and cumulative impacts.

The scientific basis for links between aquaculture activities, stressors and effects was peer-reviewed through DFO's Canadian Science Advisory Secretariat process, and the summaries of the scientific state of knowledge for each of the stressors. This information is available for use in the evaluation of aquaculture activities and the identification of where management intervention may be required to protect fish and/or fish productivity/populations.

Figure 2: Pathways of Effects for Finfish and Shellfish Aquaculture



Comment [TT44]: I would argue this statement is too restrictive and that TEK/LEK be incorporated in all elements where possible.

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Comment [TT45]: Should we also note what PoEs might not do as well with respect to cumulative effects?

Comment [TC46]: I think if you are going to use this kind of language than you need to define a "stressor", an "activity" and an "effect" in this context.

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Comment [D47]: Weaker language than assessment.

Comment [TT48]: It seems more accurate to say that PoEs are a tool that allow managers to consider the potential ecological costs/benefits of actions. The tool itself doesn't do this per say.

Comment [TT49]: Disagree, the tool won't tell you if the cumulative impacts unless the assessor specifically knows how multiple stressors interact at each site/assessment area. Clearly DFO is working on this but I think it is premature to state strongly here.

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Comment [D50]: Has this been completed? Are the results published and generally available? If so, identify the link to reports.

Comment [TT51]: Link?

Comment [TT52]: Incomplete sentence

Comment [TT53]: I think this document should highlight that Fig 2 is a potential starting point but there could be additional activities, stressors and effects (not shown) that could be important in specific cases and added to the PoE model to be considered in the RA.

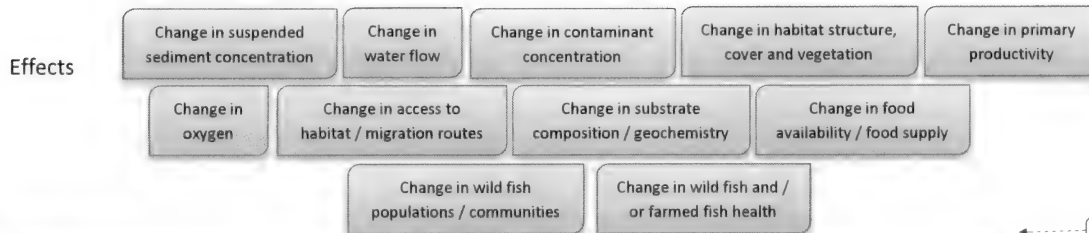
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Comment [TT54]: So is this set in stone because it is based on existing CSAS advice? Seems there are other activities, stressors or effects that could be considered. Also, not clear why the text below only focuses on stressors, especially if this has already been approved. To me it might be more informative to walk through a chain (activity-stressor-effect) rather than brief review of stressors.

Comment [D55]: Is this meant to be complete or as an example POE? eg ... [7]

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At the specific aquaculture application level, the linkages between each of the stressors and the relevant effects are considered. The specific environment and activity will determine which stressor-effect linkages exist, and what mitigation measures can be used to effectively and sustainably break the stressor-effect linkages.

- **Physical alterations to the habitat** occurs when-during activities related to placing or removing physical infrastructure (e.g. net pens, longlines, rafts, anchors and moorings, shellfish beach culture structures), as well as during the use of husbandry equipment (e.g. underwater lights to increase growth in marine finfish or acoustic deterrent devices to discourage predators⁴).

The extent and impact of the predicted physical alterations to habitat are considered primarily during the pre-operational stage (e.g. site application), which includes an evaluation of the type of benthic habitat in the area being proposed for aquaculture.

- **Release of chemicals and debris** occurs primarily with activities associated with site and stock management, and the use of operational equipment where chemicals and debris may be released. Examples include the use of pesticides, drugs and antifouling agents, and the use of materials in construction (e.g. steel, wood, floatation) and operations (e.g. feed bags, ropes), which can be lost from sites as debris.

The effect of the use of pesticides, drugs and antifoulants on the receiving environment, including on non-target organisms, is assessed by Health Canada.

- **Release of organic and related matter** occurs as a result of stock management activities (e.g. the feeding and cultivation of fish, removal or natural sloughing of biofouling organisms from physical infrastructure) that have an organic or related component (e.g. nutrients).

The predicted extent of organic deposition on the surrounding seafloor is assessed at the pre-operational stage. As part of the on-going operational compliance, marine finfish aquaculture operations must meet a performance-based regulatory requirement related to the release of organic matter.

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Comment [TT56]: But how is risk assessment being linked to PoE? I think this document needs to articulate how the major risk components (likelihood and impact) will be determined/quantified. The PoE will only articulate the relationships, the specifics for the RA will need to be determined and subsequently can be adjusted when management actions are considered.

Comment [TT57]: Isn't reduction in pressure an option here? Does it always have to break the relationship?

Comment [TC58]: Is it not also assessed by Environment Canada?

Comment [TT59]: And other related components or just organics?

⁴ Note that the use of acoustic deterrent devices is not a current practice in Canadian aquaculture.

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- **Removal/release of nutrients and organic matter** occurs as a result of stock management activities where some cultured species (e.g. bivalves) remove particulate matter, nutrients and oxygen from the water column while others through excretion release nutrients into the water column.

The predicted extent of the removal and/or release of nutrients on food-webs and wild populations is assessed at the pre-operational stage.

- **Release or removal of fish** occurs primarily as a result of stock management activities.

The removal of fish is considered and managed as bycatch. This occurs when some individual wild fish may be temporarily or permanently removed from waters along with cultured fish (e.g. during grading or at harvest), or as part of biofouling or predator control.

The addition of fish to the environment occurs either as a result of intentional stocking of cultured fish into aquatic environments for cultivation (e.g. salmon enhancement), or as a result of unintentional release of fish (e.g. escapes).

The impact on wild populations from the unintentional release of cultured organisms is considered at the pre-operational stage, and is also linked to fiduciary responsibilities associated with the *Species at Risk Act*.

- **Release of pathogens and pests** occurs ~~is~~ associated with site and stock management. The increase in biomass of fish within an aquaculture site can influence the presence or abundance of fish pathogens (e.g. bacteria, viruses) and pests (e.g. sea lice and tunicates).

The introduction of pathogens or pests is evaluated at the operational stage, primarily by the Introductions and Transfers Committees (ITC). Conditions of licence outline mitigation measures for the management of the abundance of pathogens or pests. Additionally, notifiable diseases are regulated by the Canadian Food Inspection Agency.

Additional details on the characterization of each of the stressors, the current status of regulatory thresholds, and current management and mitigation practices are found in Annex 1. Also, a case study for the management of sea lice in B.C. is found in Annex 2.

Stakeholder and Indigenous Peoples' Engagement

Stakeholder and Indigenous peoples' engagement to support sound aquaculture governance is critical. The lack of social licence licencelicense is a major barrier to robust aquaculture growth. Other factors, including the type of regulatory regime or site-specific development

Comment [D60]: Finfish and others will release non-trivial amounts of nitrogenous waste that impact pelagic and benthic food-webs.

Comment [D61]: Is this currently done or should it be added ?

Comment [TT62]: I'd suggest noting AIS separately in Fig 2 and associated text.

Comment [TT63]: We also have conditions of licence to limit the inadvertent movement of AIS (at least in BC). This should be noted as well.

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Comment [D64]: There is not a complete lack of social licence. The absence of social licence refers only to a segment of the Canadian population who object to aquaculture. This segment exists mainly in British Columbia

Comment [TC65]: This should be explained better. What do you mean by "social license" and how do you know that there is a lack of it? There is no context in this document to make the reader aware of any ongoing controversy, instead it assumes that the reader is familiar with a very nuanced and complicated conversation around aquaculture in BC. Many people will not know anything about this, particularly those from other parts of Canada or who do not have experience in our marine sector.

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capacity characteristics, may play a role, but not to the same extent as of societal acceptance. The best mechanism for sustainable growth is via coastal zone and area-based management approaches which fully engage interested stakeholders and indigenous groups, who may actually contribute to decision-making. These processes not only support general agreement of where sites should go be situated go, but also the areas of greatest concern ~~to on which to focus~~ on.

It should be recognized that some risks are new or emerging, and the evolution of scientific knowledge may influence society's tolerances and its chosen level of protection. An understanding of the "public's tolerance for risks" or "society's chosen level of protection" underpins the need for high transparency, clear accountability, and meaningful public involvement and communication.

Two-way sharing of information and the inclusion of a range of perspectives in the decision-making process can become the cornerstone of openness and transparency, and enhance credibility of and trust in the decisions that the Government develops.

Conclusion

DFO has managed aquaculture over the years based on managing environmental impacts and the potential risks these can pose to fish habitat and fish populations, as identified through the DFO peer-reviewed science process. Where relevant, DFO regulators strive to develop management standards or thresholds, which are informed by science, based on best practices globally, and have received some form of stakeholder and indigenous peoples' input.

Aquaculture management is a shared responsibility between the federal and provincial governments; thus, management frameworks need to be foundationally the same. In circumstances where there is a potential for unacceptable harm to fish (population-level effects), it may be appropriate to make decisions and implement precautionary measures in the near term, without having full certainty of the probability or magnitude of harm. Close monitoring would also occur to assess the effectiveness of the measures in addressing mitigating risk and overall impacts. Follow-up activities, including research ~~Research~~ and monitoring, are key to reducing scientific uncertainty and allow improved decisions ~~decision-~~ makings to be made in the future. Finally, stakeholder and Indigenous peoples' engagement throughout the risk management process is critical, not just at the final decision-making process.

Comment [TC66]: Why are these terms in quotations? Are they used somewhere else regularly? Who is being quoted?

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Comment [D67]: Is this document and conclusion for managers, partners, and/or the public ??

Comment [D68]: Be more specific

Comment [D69]: Do we or should we have anything to say here about the use of results from other peer reviewed science processes from the broader national and international communities of science i.e. are we attempting to be truly inclusive?

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Comment [D70]: It's not clear what the jargon "foundationally the same" means, e.g. commonly supported by both?

Comment [D71]: I don't understand this statement

Comment [D72]: Again, make sure this term is well-defined either from FA or DFO policy (with citation) in the text above

Comment [D73]: Here too there's a need to be clear i.e. population level effects are possible (?), likely (?), or observed? Sounds like potential but this comes back to the fundamental point of the difference between "any potential" as opposed to applying levels of likelihood defined by risk assessment work in relation to potential. Leaving this open will not promote transparency in communications with those who oppose these types of activities.

Comment [D74]: What does this mean ?

Comment [D75]: Research and monitoring have been focused almost entirely on near-field effects while ignoring more subtle and difficult to identify far-field effects. For example, current monitoring to identify near-field versus far-field population level, impacts on wild salmon is largely non-existent. We could do better through standardized monitoring for impacts on a spatial continuum from near to far field locations of specific salmon populations (i.e. parasite and pathogen burdens on smolts out, adults back for a "representative set of populations for which we explicitly assess productivity variations) but have yet to initiate this. Consequently, the evidence we need to defend our approach to aquaculture management to minimize impacts on wild salmon populations remains relatively weak.

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Annex 1: Details on Aquaculture Stressors, Effects and Risk Management

STRESSOR	THRESHOLD	MANAGEMENT ACTION / MITIGATION
<p>Release of pests and pathogens</p> <p>Pathogens can be endemic in wild fish populations (i.e., occur naturally in wild populations in a region) or exotic (i.e. occur naturally in other locations and have been introduced in a region). The presence of endemic pathogens can be amplified under some circumstances where fish are in close proximity (e.g. spawning grounds, schooling and aquaculture). Endemic pathogens tend to have a less severe effect effects on native populations than exotic (or introduced, non-endemic) pathogens, as over multiple generations native species have typically developed an immune response to endemic pathogens.</p> <p>The health status of wild fish often cannot be directly assessed, and changes in wild fish populations or communities due to disease are difficult to determine. Diseased and moribund fish are quickly removed from the population through processes such as predation or mortality; sampling can therefore be easily biased toward healthy individuals. The presence or absence of pathogens is particularly difficult to determine in wild fish populations, nor is and there is no available scientific data to determine the effect of low level presence of pathogens at the individual or population level.</p>	<ul style="list-style-type: none"> Sea lice threshold (B.C. only); Mandatory Reporting of Fish Health Events (i.e., treatment or % loss) (B.C. only) 	<p>Conditions of licence require treatment for sea lice above threshold (3 lice/fish in B.C.)</p> <p>Monitoring fish health is a particularly important mitigation tool when cultured fish are destined for movement to another location or for release into aquatic environments. The determination of the appropriateness of planned movements or releases of fish must be based upon a review of the disease and mortality history of the cohort, on recommendations by a qualified fish health professional, on the results of any recommended pre-release disease screening, and on guidance from regulatory agencies.</p>
<p>Release (or removal) of organic matter and nutrients</p> <p>Potential sources of the release of other organic matter include fish carcasses (e.g. from cultured fish or bycatch⁵), feed spillage, faeces,</p>	<ul style="list-style-type: none"> BOD threshold 	<p>Footprint addressed through initial siting decisions (benthic impact depositional modeling)</p> <p>Performance based threshold (on-going assessment once/production cycle) – under the AAR, sites cannot be restocked</p>

Comment [TT76]: AIS (tunicates) were noted above but no mention here as looks like all finfish. Should this be added as an example for the shellfish world? As noted above there is management related to green crab in BC.

Comment [TC77]: More detail could be provided here to make this more clear.

Comment [TC78]: Define acronyms

Comment [TC79]: Not a full sentence - needs clarification. Also, the word "footprint" should be defined so readers know what that refers to.

Comment [TC80]: Define acronyms

⁵ The release of incidental finfish catch during finfish harvest, as may be required under conditions of licence, may contribute to organic matter in the environment if the fish are dead or have a low chance of survival.

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harvest waste or offal, including blood. Release of organic matter into the marine environment from humans working and/or living on site could also constitute a minor contribution of organic matter to aquatic environments, should it occur. Human waste is generated on boats or in working or living accommodations as part of daily activities like cooking, bathing and bodily functions. The majority of organic matter introduced into the environment from finfish aquaculture will be associated with excess feed and faeces. Accumulation of the organic matter can result in a change in the benthic biodiversity around a site.		if sulphide threshold exceeded	Comment [TC81]: This is very vague and unclear to readers not familiar with the AAR. There's plenty of space here to explain more clearly what the AAR is, what the sulphide thresholds are, and why sulphide has anything to do with organic matter (anyone who is not a benthic chemist/ecologist will not necessarily know about the link between sulphides and organic matter).
Release of chemicals/drugs Pesticides are assessed by the Pest Management Regulatory Agency (PMRA) of Health Canada for value of use, and human, animal and environmental risks under the <i>Pest Control Products Act</i> . Factors considered in environmental risk assessments related to pesticides include the potential transport and dispersal of products and/or their constituents following release into waters, as well as the exposure of non-target organisms to concentrations of substances that could result in lethal or sub-lethal (e.g. behavioural, reproductive) effects. The severity of impacts on exposed non-target species will depend on factors such as the toxicity of the product used, the dosage, the presence of susceptible non-target species / life stages of species, and environmental conditions.	<ul style="list-style-type: none"> No thresholds – Research and analysis underway to provide advice on the design of a post-deposit monitoring program. 	PMRA-PMRA-PMRA-PMRA can place limits on the timing, location and volume of the release of specific materials. Under development – traffic light system for 1) pre-siting assessment to inform site placement, and 2) cumulative impacts (informed by post deposit monitoring program (site level) and aquaculture monitoring program (bay scale))	Comment [TC82]: Maybe there could be more details here on how PMRA assess risk, or links to PMRA documents that show how they assess each pesticide product. Comment [TC83]: Literally no idea what this means - need to use full sentences and be clear for readers who are not familiar with ongoing regulatory developments.
Physical alteration of habitat The addition, removal, and	<ul style="list-style-type: none"> Maximum shellfish aquaculture coverage of 7% per bay in some areas of Canada 	Primarily Alteration of habitat is pPrimarily addressed through initial siting considerations.	Comment [TC84]: Where? Who makes this rule? This is certainly not the case in many areas in the Maritimes.

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modification of physical structures may affect bottom sediments, benthic communities, pelagic communities, and hydrodynamics.		In situations where wild fish may be present only on a seasonal basis, or where habitat is used by a species during a particular period (e.g. during reproductive phases), measures to limit the duration, timing or extent of installation, harvest or site maintenance activities may be warranted.
<p>Release (or removal) of fish</p> <p>Farmed finfish, including salmon, may escape, usually due to equipment failure or human error. Equipment failure may be weather-related, or caused by predator attacks or other events that stress the containment infrastructure. For there to be genetic intrusion, establishment of non-native populations, predation or competition, farmed fish must first be released into the wild through escape or the release of viable gametes.</p>	<ul style="list-style-type: none"> Reporting of escapes may be required, depending on the jurisdiction No direct genetic impact risk on West Coast from Atlantic salmon farms 	<p>Addressed through conditions of licence and development of national containment standards (to be developed)</p> <p>Regulation of fish containment structures and use of triploid farmed fish would further lower the extent of direct genetic interaction.</p> <p>In the event that an unintentional release does occur, measures such as escape response plans may help to recover released fish, particularly where a significant risk of harmful interaction with wild populations has been identified.</p> <p>Escape reporting and analysis of the measures employed may be used to help assess the effectiveness of current mitigation measures and develop future facility or regulatory measures, as appropriate. Measures for recording and reporting cultured fish inventories as well as accurate records of introductions and transfers of licensed species support a broader understanding of the scope (estimated quantity, species and timing) of unintentional releases, and may form part of the management approach in mitigating their effects.</p> <p>In circumstances where a new species is being considered for rearing in an area for the first time, a specific environmental risk assessment is warranted to determine whether or not an Introductions and Transfers (I&T) licence should be issued (see National Code on Introductions and Transfers LINK). The Code provides guidance that the I&T risk assessment should typically focus on incremental risk aspects that are particular to that species. Species identified as higher risk may have</p>

Comment [TC88]: More clarity/detail is needed here. Use full sentences.

Comment [TC89]: Is this currently happening?

Comment [TC87]: Better explain this or somebody will get very upset!

Comment [TC85]: This term is not friendly to non-biologists

Comment [TC90]: Who makes the plans? Who is responsible for implementing the plan? The farm? DFO?

Comment [TC86]: I'm confused about the purpose of this statement. You already established in the first sentence that escapes do happen. Maybe try something like "Escapes could lead to establishment of non-native populations..."

Comment [TC91]: Is it required? Who requires it? DFO?

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Annex 2: A Case Study- Management of the salmon louse Sea Lice in B.C.

1. Description of Stressor and Potential Impact – Sea Lice

Environmental

The release of pathogens or viruses from aquaculture facilities through site and stock management is a stressor described in the Canadian Science Advisory Secretariat (CSAS) research document “Pathways of Effects for Finfish and Shellfish Aquaculture” (PoE). The primary effect associated with this stressor, as described in the PoE, is a change in wild fish and/or farmed fish health. Additional sea lice specific science advice has also been provided, and this case study and analysis draws on this advice⁶.

Comment [TC92]: Sea lice are a parasite, not a pathogen or virus. This should be better explained.

Sea lice are endemic to the Pacific Coast and are found on several species of Pacific salmon and non-salmonid species. They are also present in other areas of the world where Atlantic salmon reside, such as Norway and Scotland. There are a number of sea lice species throughout the world that have a range of hosts and life cycle characteristics. The species of sea louse that is regulated concern in B.C. from an aquaculture perspective is the *Lepeophtheirus salmonis* (the Salmon-Salmon louse); however, there is another species, *Caligus clemensi* (the Herring louse) which can occasionally occurs cause concern in aquaculture facilities. Regardless of species, The sea lice life cycle includes numerous stages, such as: the free-floating Nauplius stagesNauplius stage, infectious copepodid stage, attached chalimus stages, and finally the motile stages (pre-adults, adults).

Comment [TC93]: This sentence seems irrelevant.

Farmed Atlantic and Pacific salmon are stocked at the marine sites free of salmon lice and infection occurs by exposure to passing adult wild salmon. This is known as “spillover.” The intensity of infestation on farmed salmon is based on a number of factors including the size of the wild salmon run, sea water temperature, salinity and the health of the farmed fish. Cultured Pacific salmon are less susceptible to salmon ease sea lice infestation than Atlantic salmon. When infestation occurs at a farm the sea lice numbers may become internally amplified, which may result in “spillback” to wild salmon. Elevation of salmon louse infestation may be harmful to Of particular concern is the effect this may have on juvenile salmon smolts which have recently entered the marine environment and, as they are most susceptible to sea lice. Wild salmon smolts out-migrate from their natal streams during the spring and early summer. A corresponding “out-migration window”, from March 1st to June 30th with more stringent different requirements for management of lice levels, is incorporated into the farm licence

Comment [TC94]: Any references for this information?

Comment [TC95]: Susceptible in what way? To infestation or to negative health impacts as a result?

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Comment [TC96]: What different requirements? Maybe leave this until the following section if it won't be explained here.

Field Code Changed

⁶ Assessment of Sea Lice Monitoring and Non-Chemical Measures, DFO 2014 SAR 2014/006

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conditions. The out-migration window as currently defined runs from March 1st until June 30th annually.

Social

There is a high level of concern from a segment of the public, some First Nations and ENGOs, on the impact aquaculture has on wild Pacific salmon, and more specifically on the belief that sea lice can significantly negatively impact wild salmon populations. Wild salmon populations can be highly variable and in some cases a low run in one year can be followed by record high numbers; this happens in areas both with and without aquaculture facilities on migratory routes. Conflicting opinion about the possible impact of high levels of sea lice has not given these groups, governments, the media or the Canadian public a level of comfort that the Department is properly managing the risk the aquaculture industry may pose to wild salmon.

2. Current Management and Mitigation – Sea Lice

The goal of the current management approach is to ensure that no disease or disease agent negatively impacts the protection and conservation of fish. Presently, risk related to sea lice is managed through licence conditions and the Fish Health auditing program.

Pre-Operational Management Approach

The Precautionary Approach is applied during the consideration of new sites, both from a site-specific and broader area perspective. This is also true for applications for increased production at an existing site. There is recognition of the potential risk of increased sea lice abundance and corresponding infection of out-migrating salmon from licenced facilities as a result of increased salmon production at the farm or area level. Assessments including the history of sea lice abundance levels at that farm and neighbouring farms in the general area include recommendations for mitigation measures, such as area-based management (e.g. coordinated and timing of stocking, fallowing and sea lice treatments), maintenance of single-year classes, practicing integrated pest management, and timing of stocking to reduce the need for sea lice treatments. Geographic elements considered during the assessment include hydro-connectivity between the proposed site and adjacent farms, and proximity to known salmon migration routes.

When siting new facilities, eEffortsefforts are made to avoid the siting of new aquaculture facilities in areas which are known to be important wild fish migration routes, nurseries, sensitive habitats, or have other importance to wild fish populations or significant to First Nations. Ongoing science and research forms part of this consideration.

Comment [D97]: An elevated level of comfort may be achieved through more effective communication strategies that high-light what is being done to manage salmon lice. Also years ago, DFO ran an annual sea lice surveillance program on juvenile wild salmon in the Broughton – and posted the monthly results on-line. This kind of information established what are the normal levels of lice on juvenile salmon, what constitutes high levels, and how often high lice levels occur.

Comment [D98]: This is in part due to the fact that monitoring of wild salmon population variations in near-field and far-field locations along with assessment variations in the seasonal to annual sea-lice reservoir created by aquaculture facilities has not been designed or implemented to yield results that are more precise in pinpointing causes of salmon population level variations than these circumstantial assertions that variations occur due to all sorts of factors.

Comment [TC99]: This section needs some references to support this information.

Comment [TT100]: But it often is impossible to reach agreement on opinion which is where scientific evidence comes in. Clearly there are many factors at ... [8]

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Comment [TC101]: Sea lice are not a disease. If sea lice are being linked to the spread of a disease as an agent, than this needs to be explained.

Comment [TT102]: Not sure what this means

Comment [TC103]: What is the Fish Health auditing program? Who runs the program? Needs more detail.

Comment [TC104]: Who is considering the sites? Province or DFO? Who is applying the precautionary approach?

Comment [TC105]: By who? Who is recognizing? DFO?

Comment [TC106]: Who is conducting the assessments? Are they mandatory? How many are there? Who decides?

Comment [TC107]: Who makes these efforts?

Comment [D108]: There are virtually no areas along the BC coast where risks to one or more salmon populations of ... [9]

Comment [TT109]: But clearly this is only part of the process as I'm sure decisions have been made to allow activities in areas that at least one ... [10]

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Current Operational Management Approach

The licence conditions include sea lice monitoring protocols as well as sea lice abundance thresholds that a licence holder cultivating Atlantic salmon must abide by. The cornerstones of sea lice management in BC are routine monitoring and the application of a management threshold. During the outmigration period, sea lice counts are conducted by industry sampling on farms is required at least every two weeks at minimum during the out migration period. During this time, and DFO conducts sea lice audits by sampling auditing of the reported numbers and sampling methodology occurs on 50% of all active farms during this time. For the remainder of the year, sampling by industry is only required once per month. The sea lice management threshold is, but will increase to every two weeks if threshold levels three motile (pre-adult and adult) lice (*Lepeophtheirus salmonis*) per fish are exceeded. This threshold is set at an average of three motile (pre-adult and adult) lice (*Lepeophtheirus salmonis*) per fish. During the outmigration period, During the outmigration window, salmon farmers are required to maintain lice are maintained levels below the three motile lice threshold level, typically by harvesting or treatment. Outside this period, there is no they are not obligation that farmers must maintain levels below the edobligated to maintain theisthis threshold, but must notify DFO must be notified when the threshold is they exceedexceed it and develop a mitigation strategy must be developed for consideration by DFO officials. This system allows for lice control during the sensitive out-migration period, but does not require treatment outside this period, thereby reducing the use and potential development of resistance to various sea lice therapeutants. Sea lice sampling on farms is required every two weeks at minimum during the out-migration period, and DFO auditing of the reported numbers and sampling methodology occurs on 50% of all active farms during this time. For the remainder of the year, sampling by industry is only required once per month, but will increase to every two weeks if threshold levels are exceeded.

Comment [TC110]: What license conditions? For what license? (I know you are talking about the fish farm, but it's not made clear).

Comment [TC111]: How do they do this? What happens if they exceed?

Comment [TC112]: Sampling by who?

Comment [D113]: Defined on what basis and in which locations ?

Mitigation

Companies are increasingly moving towards an area-based management approach where all smolts in a given area are the same year-class and, if treatments are required, they are coordinated among between these sites. Treatments are ideally timed in coordinatedonecoordination with the migration of returning adult wild fish so that all wild fish have left the area before treatment is initiated. This is to avoid reinfection and retreatment which can lead to resistance. Currently the primary sea lice treatment is the use of emamectin benzoate (SLICE), which is an in-feed parasiticide.

Comment [TC114]: wild or farmed smolts?

Comment [D115]: Same comment as immediately above.

Recently in some areas in B.C., SLICE there is evidence that salmon lice have elevated resistance to SLICE has emerged in recent years. Industry is rapidly developing integrated pest

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management strategies alternative treatment modalities to curtail SLICE resistance, and prevent the development of wide-spread resistance in the sea lice population in B.C. Theseis include This involves the rotational use of alternative treatment methods, such as novel in-feed parasiticides, hydrogen peroxide baths and/or mechanical sea lice removal (e.g. Hydrolicer). An alternate method of reducing absolute sea lice inventory is through harvesting, which typically would occur when fish are near harvest weight. This method is only effective if harvesting is done at a rate that reduces a farm's permissible absolute sea lice inventory (as defined in the licence).

3. Scientific Certainty – Sea Lice

A large number of scientific studies have been conducted in recent years which have tried to determine what, if any, harm is posed to wild salmon by sea lice spillback from Atlantic salmon farms. No conclusive evidence has been found to suggest that sea lice originating from farms are causing harm to wild stocks on a wide scale. This has largely been accepted by stakeholders and opponents to the salmon farming industry. This indicates that the three motile threshold is sufficiently conservative to mitigate risk to wild salmon posed by sea lice originating from farms. In the rare instances where farms have not been able to control lice levels during the out-migration period (often as a result of SLICE resistance), lice levels are found to be higher on out-migrating wild salmon smolts. This indicates that lice management on farms is vitally important to prevent potentially harmful an undue lice burdensburden on wild smolts.

4. Residual Risk and Application of the Precautionary Approach – Sea Lice

Environmental

A changing climate may makes future lice mitigation more uncertain and challenging. The effects of In years with warmer water temperatures and increased salinity on the management of lice are poorly understood and should be the focus of research. becomes more difficult. This is likely to become more common as time progresses. The limited availability of sea lice treatment options in BC inevitably led to increased evidence of resistance to SLICE, as has been observed in many other jurisdictions around the world. Additionally, the emergence of SLICE resistance on B.C.'s coast has presented a significant challenge to industry for effective lice management. However, ~~the~~ the adoption of alternative additional treatment strategies options by industry is very welcome and indicates has demonstrated that lice levels can should be able to still be effectively managed controlled, despite a changing climate and without sole

Comment [TC116]: I'd like to see a much better discussion of the available scientific evidence, as well as acknowledgment of the existing knowledge gaps. As written, it is not defensible, and will not succeed in convincing anyone that DFO has done enough to protect wild salmon from sea lice.

Comment [TT117]: Seems an odd title!

Comment [TT118]: So they are causing harm on smaller scales? This wording should be more specific.

Comment [TC119]: I highly disagree with this statement - as far as I can tell, opponents of salmon farming are certainly not satisfied that sea lice are not harming wild salmon.

Comment [TC120]: I disagree that a lack of conclusive evidence is an indication that the threshold is sufficient. I think this statement needs to be better supported.

Comment [D121]: Failure of SLICE treatments has not always been due to resistance.

Comment [D122]: This observation if supported with sufficient data would suggest that all parasites/pathogens will generate similar concerns. However if we adhere to the position that population level harm is likely to be associated with frequency of occurrence on either juvenile or adult fish without any demonstration of associated changes in productivity we may be subjecting aquaculture development to greater precaution than necessary. The alternative is to design a standard (... [11])

Comment [TT123]: Since the title of this section is scientific certainty do we actually know how confident we are in the 3 motile threshold? If we are at 4 are we in the realm of major impacts? It (... [12])

Comment [TC124]: This whole section is very confusing. The arguments appear to be contradictory - on the one hand there is no evidence that lice from farms affects wild stocks, but on the other sea li (... [13])

Comment [TC125]: What does residual risk mean? What constitutes a "residual" risk, and how is it different from a regular risk?

Comment [D126]: All the more reason to consider the type of monitoring and evaluation of potential spatial and temporal variations in impacts on wild salmon populations noted above.

Comment [TT127]: But the RA should have a timeframe identified, usually this is done at the scoping phase so the risk calculations have an actual basis. Where is this defined?

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reliance on SLICE. Effective management is vital to ensure that wide-spread resistance to lice therapeutants does not occur as it has in other jurisdictions. Ongoing research into the genetic determinants of lice resistance, use of cleaner fish, alternative treatments and alternative cage designs/husbandry methods are all very promising, and should be encouraged and supported to allow proactive management by industry. Under the present management regime, the residual risk once operational is determined to be medium. Application of the Precautionary Approach requires that the Department utilize existing and potential new management measures to ensure that the risk stays within an acceptable range.

	Risk Attributes			
Context		High	Moderate	Low
	High			
	Moderate		X	
	Low			

Social

Based on the level of scientific certainty that sea lice are not causing harm to wild fish populations, the level of concern raised by the public is expected to diminish over time. Due to the variable nature of wild salmon returns there may continue to be a perception that declines in wild salmon populations are related to sea lice impacts. As noted above, uncertainty environmental residual risk exists based on changing climate conditions. It is incumbent on DFO to ensure a robust scientific program remains in place to better understand how the change in climate conditions is affecting sea lice, and their interaction with farmed and wild fish. If this scientific research along with changing management requirements (as necessary) is communicated to the public in a pro-active manner, social acceptance should increase.

	Risk Attributes			
Context		High	Moderate	Low
	High			
	Moderate		X	
	Low			

5. Next Steps and Future Developments – Sea Lice

Comment [TC128]: This is confusing. It has already occurred in BC, as stated. What jurisdictions are being referred to here?

Comment [TC129]: Who is doing the research?

Comment [TC130]: People not involved in research probably won't understand this.

Comment [TT131]: What does this mean? The actual determination of risk would include mitigative measures already so is this some down weighted formulation? Based on framework above it seems there should have been a risk calculation based on the PoE. It is also not clear that residual risk is entirely related to uncertainty nor is it articulated how uncertainty is characterized/quantified/used in the RM element.

Comment [D132]: A formal risk assessment for sea lice should be conducted. To my knowledge, this has not yet been done and this document ... [14]

Comment [TC133]: What does this mean?

Comment [TT134]: As defined by management?

Comment [TC135]: What is this table? What is the context and how was it ... [16]

Comment [TT136]: So normally a RA table would indicate likelihood and ... [15]

Comment [D137]: Public concern will be diminished through the applica ... [17]

Comment [TC138]: That's very optimistic. Not sure that it is true.

Comment [TT139]: Is this part intended as a full SE RA?

Comment [TT140]: Again, I think there is confusion over residual risk and ... [18]

Comment [TT141]: That better characterizes spatial and temporal ... [19]

Comment [D142]: Same comment as immediately above. ... [20]

Comment [D143]: Effective communication of risks to wild salm ... [22]

Comment [TT144]: But this is based on some expectation of the underlyin ... [21]

Comment [D145]: This table implies a risk assessment has been undertak ... [23]

Comment [TC146]: Tables need to be explained.

Comment [TT147]: So this is saying SE risk is Moderate? Really not clear ... [24]

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DFO conditions of ~~licence~~~~license~~~~licence~~ relating to lice have been found to be vague, outdated and sometimes unenforceable. Some preliminary ideas on changes to the licence to allow better regulation, while also providing additional tools and guidance to industry, include:

- Consider moving to ~~adult female-based threshold~~, rather than current motile threshold.
- Establishment of a farm-based, in addition to a fish-based (as currently used), sea lice threshold (For example, we assume 500 000 fish on farm, with three ~~motiles~~~~motile lices~~~~motiles~~ = 1.5 million lice allowable on a single farm).
- Harvest ~~alone would~~~~would~~ no longer be deemed an appropriate management action within the out-migration ~~period~~ (it [would only be used to lower the farm-based "absolute sea lice inventory" below the farm-level threshold, (as mentioned above, ~~e~~) before entry into out-migration-]).
- Change the ~~licence~~~~license~~~~licence~~ condition of "active farm" away from number of pens stocked (more than 3), to the absolute number of fish on site for a given time (e.g. active site could be defined as: more than 30 days have passed since the introduction of more than 50 000 fish to a sea site).
- Consideration ~~should~~ be given to initiating mandatory sea lice reduction prior to March 1, which is the generic-general time when out-migration is recognized to start, as stated in licence conditions.
- Implement mandatory post in-feed lice treatment reporting to better monitor efficacy.
 - E.g. 25-30 days have passed since the completion of treatment with an in-feed parasiticide medication.
- Implement prohibition ~~on~~~~Prohibit~~ use of lice chemical ~~therapeutant~~~~therapeutant~~ for a time in response to resistance.
 - E.g. treatment failure could be defined as: "failure to achieve > 60% reduction in pre-treatment lice numbers at the 25-30 day post-treatment counts".
- SLICE use would be prohibited at that site again during the calendar year.

Moving forward ~~the~~~~The~~ Department must continue to participate in global networks of sea lice researchers, and focus its research efforts on relevant areas including do scientific research on sea lice interactions between and its relationship to farmed and wild salmonids in the context of climate change in order to develop a clearer understanding of the possible linkages between the two and the corresponding risk to cultured and wild fish. and the development of alternative sea lice management strategies. It should also be cognizant of and, review related independent science (science which comes from sources outside of DFO), and react to key new findings by adjusting our research objectives. Operationally DFO must adapt to new science, making changes to present management approaches as necessary.

Comment [D148]: Who found this? This statement requires more context and detail.

Comment [D149]: Norway uses an all female threshold. In Norway they are still challenged to manage lice levels. Our motile threshold is more robust because it includes male and female adult and preadult stages

Comment [TC150]: female lice?

Comment [TC151]: This is super confusing - especially to anyone not familiar with the current licence conditions. Should be explained more clearly.

Comment [TC152]: But wouldn't this increase the risk of SLICE resistance as previously discussed?

Comment [D153]: Existing industry treatment data show most treatments are initiated well before the outmigration window

Comment [TC154]: I don't understand this at all. Do you mean report on the lice numbers/fish health after a certain time has passed since the application of SLICE?

Comment [TC155]: Explain more clearly. For example "A farm that fails to achieve a specified reduction in lice numbers after treatment with SLICE would be considered resistant, and continued use of SLICE at that farm would be prohibited. A failure could be defined, for example, as a less than 60% reduction in lice numbers from the period immediately before treatment and the 30th day after treatment.

Comment [TC156]: Which site? The site that failed?

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Although the risk posed by sea lice to juvenile wild salmon is considered low based on our present scientific understanding, a Precautionary Approach to the siting of new farms in the future could incorporate the potential of sea lice becoming a higher risk because of changing environmental conditions.

Over and above the current operational management approach, it is recommended that a risk-based traffic light system be implemented that would be tied to some objective measure of sea lice abundance (e.g. number and severity of exceedances). This approach could amalgamate information from an individual farm or a number in a geographic area that have hydro-connectivity. It is well established that sites which have good overall fish health performance, including a low sea lice burden, are less likely to become susceptible to disease.

A green designation would indicate that historically a site has good sea lice management with rare incidences of threshold exceedance and low or negligible mortality indicating a low residual risk to wild salmon. The Department could consider increases in production at these sites. A yellow designation would indicate some recurrent sea lice threshold exceedances that are able to be managed on site without the risk of associated fish health issues and do not represent a notable threat to wild salmon. Increases in production would not be considered and additional management measures may be required. A red designation would indicate serious, significant or repeated sea lice exceedances that could potentially represent a notable threat to wild salmon. Drastic management measures could include reducing authorized production, a requirement to fallow for a significant time period, or cancellation of the licence.

At present there is a lack of flexibility in the licence conditions to require actions such as those outlined for farms designated red as the Department does not have the legislative authority. Moving forward the Department should pursue legislative/regulatory changes to obtain this authority.

Comment [TT157]: How was this determined? Presumably this is a different calculation than what is presented in both « risk tables » where the residual risk was moderate (which actually implies the original or unadjusted risk was at least as high if not higher).

Comment [D158]: There is a need to thoroughly discuss the traffic light (i.e., the Norwegian system) management approach, and whether it, or a modified traffic light approach to sea lice management will work in BC.

Comment [TC159]: What is a traffic light system? Explain.

Comment [D160]: Alternatively, recognition of clear differences in sea lice risk on farms among management areas in BC indicates the potential value of region-specific management strategies.

Comment [TC161]: What disease? You haven't established any link between sea lice and disease.

Comment [TC162]: This explanation should follow immediately after the proposed system is mentioned above. The current paragraph structure is very confusing.

Comment [TT163]: So are these levels based on the PoE/RA/RM elements? Not sure of the basis for these conclusions.

Comment [TC164]: But there is no current red designation? Isn't the traffic light system just proposed?

SEPTEMBER 18,2018 DRAFT

APPENDIX I: Marine Finfish Pre-Operational Risk Table

There are a number of elements that are already assessed at the pre-operational application stage and the risks are summarized for senior management in a table.

Farm name:	Company:			
Elements Assessed – Wild Fish and Fish Habitat	Low	Med	High	N/A
Presence/use and interactions with CRA fishery or rare species				
Presence of important fish habitat (e.g. sponge reefs, rockfish nursery, etc.)				
Presence/use and interactions with SARA listed species				
Appropriate distance to salmonid-bearing streams				
Appropriate distance to important herring spawn areas				
Appropriate distance to shellfish beds				
Appropriate depth, currents and benthic substrate				
DEPOMOD predictions acceptable				
Existing seabed conditions (e.g. capable of assimilating waste)				
Historic benthic monitoring results				
Use of lights				
Marine mammal usage & mitigation				
Elements Assessed – Fish Health	Low	Med	High	N/A
Diseases of concern on farm, nearby farms, and in area (if known)				
History of appropriate disease management on farm and nearby farms				
Prudent history of medicant use (if known)				
Hydrological connectivity with other farms & co-management plan(s)				
History of compliance and reporting on FH and SL				
Adequacy of submitted FHM, SOPs and Carcass Management Plans				
Water quality (e.g. DO, water flow; if known) & mitigation				
Natural challenges (e.g. plankton issues, harmful algal blooms; if known) & mitigation				
Fish density appropriate to maintain good FH (if known)				
Species intended to be grown is appropriate for the area				
History of predator stress & mitigation (if known)				
Elements Assessed – Sea Lice	Low	Med	High	N/A
Natural occurrence of sea lice at site				
History of staying below sea lice thresholds during smolt out-migration				
Appropriate use of available tools to manage sea lice in future				
Elements Assessed – Existing Fisheries	Low	Med	High	N/A
CSSP closure on bivalve shellfish beds used in CRA fisheries				
First Nations FSC fisheries/site access				
Commercial fisheries (direct or indirect displacement – reduction in stock				
Recreational fisheries (direct or indirect displacement – reduction in stock				
EFA/test fishery/research area				
Geoduck beds				

SEPTEMBER 18, 2018 DRAFT

Theraesa Coyle Comments:

My main concern with the document is that it is not clear to me who it is for and what its purpose is. The content is very broad and vague, leading me to think that it is for a very general audience, but a lot of the language is very specialized, leading me to think that it is intended for DFO scientists or others with an in depth knowledge of fisheries, biology or DFO. I think it would be valuable to be more clear in the introduction – what is this document, who is it for, and what is its purpose? If it is for a general audience, then there needs to be more attention to language. Complicated or specialized terms like “ecosystems approach”, “population-level effects” or “genetic intrusion” need to be better defined or avoided. There are also a lot of references to regulations and processes that only someone with in-depth knowledge of aquaculture would understand (such as references to the AAR, stock management, etc.), and these would need to be better explained. If the document is for biologists/DFO, then these terms are generally fine to use, but the document is so vague that I don’t see what a biologist would gain from reading it. As a biologist, I don’t feel like it told me anything that I didn’t already know. If the purpose of the document is to detail how DFO is implementing these principles, then it should be far more specific and detailed. For example, what (specifically) is being monitored by DFO? Who is doing the monitoring (ex. scientists, managers, third-party contractors)? Who is reviewing the data and what decisions are being made? What are the issues surrounding aquaculture? How much of this framework is already implemented and what needs to be changed or improved? As it stands, the content is far too general, and often very confusing.

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Page 3: [1] Comment [TT8] **Therriault, Thomas** **09/10/2018 4:09:00 PM**

It is conceivable that almost any activity has the potential to cause harm (hence the need for assessment) but isn't the goal to identify those that have a higher likelihood or probability? The only true measure of this would be once the threshold is passed but by then it is too late.

Page 3: [2] Comment [TT11] **Therriault, Thomas** **09/10/2018 4:09:00 PM**

Not sure how we actually got to this conclusion here. Is this wording directly from one of the Acts or is this the basis for the framework ?

Page 3: [3] Comment [TC10] **Theraesa Coyle** **09/10/2018 4:09:00 PM**

This statement does not follow logically from the previous statement. Why would using proxies for biodiversity mean that population-level effects are the threshold for unacceptable harm? A proxy refers to the actual variable that is measured in lieu of biodiversity, not the definition for harm. This needs to be more clearly explained.

Page 3: [4] Comment [TT13] **Therriault, Thomas** **09/10/2018 4:09:00 PM**

Clearly there are many of these with varying degrees of applicability here. Why this specific example ?

Page 3: [5] Comment [TC12] **Theraesa Coyle** **09/10/2018 4:09:00 PM**

Which activities? Aquaculture activities? Marine activities? Anthropogenic activities? Needs to be more specific.

Page 3: [6] Comment [D18] **DFO-MPO** **09/10/2018 4:09:00 PM**

Again, the notion of permanent requires further definition. If one defines this in terms of human life-spans, a permanent change is one that lasts longer than the average generation time of our population (e.g. 80 years or less) but from an ecological or evolutionary perspective 80 years is a temporary condition.

Page 9: [7] Comment [D55] **DFO-MPO** **09/10/2018 4:09:00 PM**

Is this meant to be complete or as an example POE ? eg 'removing' marine mammals from around sites should be included

Page 18: [8] Comment [TT100] **Therriault, Thomas** **09/10/2018 4:09:00 PM**

But it often is impossible to reach agreement on opinion which is where scientific evidence comes in. Clearly there are many factors affecting salmon productivity year to year and aquaculture may or may not be contributing. Thus, the strength is in a robust approach that considers or even quantifies these in a way that is clear to stakeholders and FN. In many cases this will include new science but should this be linked also to near- and far-field effects work or environmental monitoring?

Page 18: [9] Comment [D108] **DFO-MPO** **09/10/2018 4:09:00 PM**

There are virtually no areas along the BC coast where risks to one or more salmon populations of importance to First Nations or others will be low or absent by definition.

Page 18: [10] Comment [TT109] **Therriault, Thomas** **09/10/2018 4:09:00 PM**

But clearly this is only part of the process as I'm sure decisions have been made to allow activities in areas that at least one stakeholder/FN group would consider significant/important to them. It may help to frame this in the context of the various factors that feed into management decisions but that at the end of the day, when precaution is considered, decisions are made that might not be agreeable to all.

Page 20: [11] Comment [D122] **DFO-MPO** **09/10/2018 4:09:00 PM**

s.21(1)(a)

s.21(1)(b)

This observation if supported with sufficient data would suggest that all parasites/pathogens will generate similar concerns. However if we adhere to the position that population level harm is likely to be associated with frequency of occurrence on either juvenile or adult fish without any demonstration of associated changes in productivity we may be subjecting aquaculture development to greater precaution than necessary. The alternative is to design a standardized monitoring program on wild salmon populations that provide contrast in spatial proximity to aquaculture facilities to determine whether PoE models that suggest risk(s) from parasites and pathogens varies inversely with distance are reliable. The cost of this type of monitoring would likely be less in the moderate to long term than our current practice of dealing with each parasite and pathogen as a special case.

Page 20: [12] Comment [TT123] Therriault, Thomas 09/10/2018 4:09:00 PM

Since the title of this section is scientific certainty do we actually know how confident we are in the 3 motile threshold ? If we are at 4 are we in the realm of major impacts ? It seems there is additional work required to better understand if we might be stacking precaution on precaution which would have a cost to industry.

Page 20: [13] Comment [TC124] Theraesa Coyle 09/10/2018 4:09:00 PM

This whole section is very confusing. The arguments appear to be contradictory - on the one hand there is no evidence that lice from farms affects wild stocks, but on the other sea lice management on farms is vitally important to protect wild smolts? I suspect that the language here needs to be navigated very carefully to avoid upsetting a lot of people.

Page 21: [14] Comment [D132] DFO-MPO 26/09/2018 9:38:00 AM

A formal risk assessment for sea lice should be conducted. To my knowledge, this has not yet been done and this document should make no statement that suggests otherwise.

Page 21: [15] Comment [TT136] Therriault, Thomas 09/10/2018 4:09:00 PM

So normally a RA table would indicate likelihood and consequence. What does context and attributes actually relate to ? Further, who determined the underlying colour scheme ? This is often determined based on risk tolerance and so it is very unclear how RA and RM are actually being applied in this working example. If not transparent it won't be possible to replicate nor will stakeholders/FN believe the process is transparent.

Page 21: [16] Comment [TC135] Theraesa Coyle 09/10/2018 4:09:00 PM

What is this table? What is the context and how was it determined to be moderate? Needs an explanation.

Page 21: [17] Comment [D137] DFO-MPO 25/09/2018 5:33:00 PM

Public concern will be diminished through the application of effective communication strategies

Page 21: [18] Comment [TT140] Therriault, Thomas 09/10/2018 4:09:00 PM

Again, I think there is confusion over residual risk and uncertainty.

Page 21: [19] Comment [TT141] Therriault, Thomas 09/10/2018 4:09:00 PM

That better characterizes spatial and temporal variables contributing to observed variability/understanding ?

Page 21: [20] Comment [D142] DFO-MPO 09/10/2018 4:09:00 PM

Same comment as immediately above.

Page 21: [21] Comment [TT144] Therriault, Thomas 09/10/2018 4:09:00 PM

But this is based on some expectation of the underlying belief systems of stakeholders/public/FN which I suspect we've not characterized well.

Page 21: [22] Comment [D143]	DFO-MPO	26/09/2018 9:40:00 AM
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Effective communication of risks to wild salmon from other human activities (e.g. fisheries) are also required.

Page 21: [23] Comment [D145]	DFO-MPO	26/09/2018 9:40:00 AM
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This table implies a risk assessment has been undertaken – which to my knowledge is not the case.

Page 21: [24] Comment [TT147]	Therriault, Thomas	09/10/2018 4:09:00 PM
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So this is saying SE risk is Moderate ? Really not clear how this was determined and similar comments on risk calculations and risk management considerations affecting the underlying colour scheme.

**Pacific Region comments from the document titled: Application of the Precautionary
Approach within a Risk Management Framework for Aquaculture**

Overarching issues identified during review of this document:

- The document does not have a clear purpose on what audience it is trying to address
- Language is very technical without much explanation of terms which could confuse the reader depending on who this is meant for
- The document makes broad assumptions that the reader is well versed in the controversies that accompany open net farming in BC. These should be explained in more detail
- Example of Sea Lice as a case study needs a lot of work as it seemed to confuse almost all who read it.
- Most have expressed that a much more focused approach needs to be taken for this document to have become meaningful in the context of aquaculture on the west coast of Canada.

Comments from email correspondence

John Chamberlain:

I gave this document a quick read through last night –

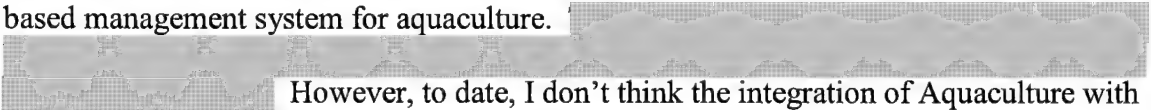
While I recognize that the pressure is on and timelines are tight, NHQ sending this document out for broad review in its current state is at best a tremendously poor use of Departmental resources. To my mind it needs a detailed review by a small number of SMEs from across the country to provide the necessary level of revisions – following that a broader review should be conducted which should take less time as the major issues will have been addressed.

Diana Dobson comments:

I think developing this risk management framework is useful. However, I think more detail is required to describe how it is applied and what the links are to other related assessment and management processes for species that are potentially impacted by aquaculture activities. Overall, it seems very regulatory – i.e. setting up conditions of licence – as opposed to supporting an ecosystem approach to assessment and management. I think the latter approach suggests that ‘aquaculture management plans’ should be required for some level of spatial aggregation, but I’m not sure that is the intent here.

s.21(1)(a)

s.21(1)(b)

1. Page 1. More explanation is required to define and explain what 'proxies are used as practical measures for managing the environment'. Further, I don't think we actually 'manage the environment', but rather we attempt to manage impacts on the environment. Also, how are the thresholds determined for activities that have the 'potential to cause a population-level harm?' And what is defined as a population level harm? I don't think later sections of the document adequately flush these concepts out yet they seem foundational to this approach.
2. Page 2. Emphasis on integration with the SFF. Page 5. Emphasis on ecosystem approach, etc. Overall, there seems to be hints at implementing some kind of ecosystem-based management system for aquaculture. 

However, to date, I don't think the integration of Aquaculture with other sectors in the department has been effective. There are missing elements in this document that more or less speak to that story. For example:

 - a. Page 6. Roles and responsibilities for risk assessment: Especially in the BC salmon context, it puzzling to me why there is no mention of existing salmon assessment and management programs – how do folks already working on salmon (who have the expertise on local populations) contribute to the process? (I'm sure these issues apply to other species.) There are situations where we are already applying similar risk assessment methods to support recovery and rebuilding of wild salmon populations and aquaculture activities are identified as threats. Shouldn't there be some integration here? (I know for example that Cermac showed up in force at recent WCVI chinook rebuilding meeting in Tofino because 'they want to change the way they do business'.)
 - b. Page 9. Stakeholder and Indigenous Peoples' Engagement:. There are several management / stewardship tables already in place for species affected by aquaculture activities. Same comment as above: shouldn't there be some integration?
3. Page 15. Management of sea-lice case-study example in the context of BC salmon. What has always struck me in the BC wild salmon-fish farm debates, is the extent to which the sea-lice issue has dominated the discussion. However, as the pathway of effects diagrams illustrate there are many other potential impacts of aquaculture activities on salmon. On page 16, 'ongoing science and research' is cited as supporting considerations to the extent to which aquaculture sites affect nursery habitat and migration routes of impacted salmon species, but this is weak. What is fundamentally missing are ongoing monitoring programs (of the impacted species) and basic survey work to identify critical marine habitat for salmon.
4. Page 17. 'Area-based approaches' are described in the application of mitigation measures for sea-lice management. Suggest 'area-based' approaches are required for siting decisions, etc. and that the decision-making processes need to be more inclusive. (related to comments above).

s.21(1)(a)

s.21(1)(b)

5. Page 18. 'Management measures'. Is this risk management framework supporting licencing only or the development of 'integrated aquaculture management plans' – i.e. similar to IFMPs or Rebuilding Plans?
6. Page 21. Risk table – what is an appropriate distance from a salmon bearing stream? How is this defined? What about density of aquaculture sites within an area?

Theraesa Coyle Comments:

My main concern with the document is that it is not clear to me who it is for and what its purpose is. The content is very broad and vague, leading me to think that it is for a very general audience, but a lot of the language is very specialized, leading me to think that it is intended for DFO scientists or others with an in depth knowledge of fisheries, biology or DFO. I think it would be valuable to be more clear in the introduction – what is this document, who is it for, and what is its purpose? If it is for a general audience, then there needs to be more attention to language. Complicated or specialized terms like “ecosystems approach”, “population-level effects” or “genetic intrusion” need to be better defined or avoided. There are also a lot of references to regulations and processes that only someone with in-depth knowledge of aquaculture would understand (such as references to the AAR, stock management, etc.), and these would need to be better explained. If the document is for biologists/DFO, then these terms are generally fine to use, but the document is so vague that I don't see what a biologist would gain from reading it. As a biologist, I don't feel like it told me anything that I didn't already know. If the purpose of the document is to detail how DFO is implementing these principles, then it should be far more specific and detailed. For example, what (specifically) is being monitored by DFO? Who is doing the monitoring (ex. scientists, managers, third-party contractors)? Who is reviewing the data and what decisions are being made? What are the issues surrounding aquaculture? How much of this framework is already implemented and what needs to be changed or improved? As it stands, the content is far too general, and often very confusing.

Cathryn Murray comments:

#1 The document makes no mention of DFO's previous work on risk assessment of aquaculture, other than the Pathways of Effects model reviewed in 2009. Pathways of Effects is not a risk assessment tool, but can be used to scope a risk assessment. There are a number of other risk assessment initiatives within DFO that would be useful to examine, build upon and reference (Mimeault et al 2017; Bastien-Daigle 2007; DFO 2006). See section below for more details.

#2 p. 3 “Therefore, the threshold for unacceptable harm to fish or fish habitat is any activity that has the potential to cause a population-level effect to fish species.” This may be the most

important statement in the entire document and should be worded very carefully. In particular, it needs to be deconstructed to address the definition of harm and its acceptability (threshold). Both the federal and provincial environmental assessment has definitions and guidance for evaluating projects (which could be used for activities or sectors, such as aquaculture). CEAA focuses on “significant adverse environmental effects” and evaluates three components – whether the environmental effects are adverse, whether the adverse environmental effects are significant, and finally, whether the significant adverse environmental effects are likely.

<https://www.canada.ca/en/environmental-assessment-agency/services/policy-guidance/determining-project-cause-significant-environmental-effects-ceaa2012.html>

Thresholds are a value judgement, typically set by regulators, through consideration of evidence and societal acceptance of harm. An adverse effect may be highly unlikely but it may be considered of such significance that the risk is unacceptable. Conversely, there may be significant risk but if the decision-makers feel the benefits of the activity outweigh the possible risks, then it may be an acceptable risk. Suggest you separate harm from its acceptability throughout as these components require different assessment processes and stages of consultation. A number of papers have suggested that the affected communities, First Nations in particular, should be involved both in the definition of threshold significance and the risk assessment (Joseph et al 2017; Murray et al 2018).

#3 The definition of risk and the matrix of evaluating risk is inconsistent with previous work and international standards (why use Risk x Context rather than Exposure x Consequence). The axes of evaluation given (Risk and Context) were not defined anywhere in the document. The colouration of the risk table in the case study is not consistent with the precautionary approach – high risk only comes with High x High interactions on the matrix, while the majority of the possibilities result in a low risk score.

#4 There are numerous unattributed and potentially controversial statements on scientific evidence in the sea lice case study with no references given.

- e.g. p. 18 “Based on the level of scientific certainty that sea lice are not causing harm to wild fish populations the level of concern raised by the public is expected to diminish over time.”
- p. 17 “No conclusive evidence has been found to suggest that sea lice originating from farms are causing harm to wild stocks on a wide scale. This has largely been accepted by stakeholders and opponents to the salmon farming industry.” What is a wide scale? Bay, basin, ocean?
- p. 17 “three motile threshold” not defined or referenced
- P. 17 “In the rare instances where farms have not been able to control lice levels during the out-migration period (often as a result of SLICE resistance), lice levels are found to be higher on out-migrating salmon smolts.” How is rare defined?

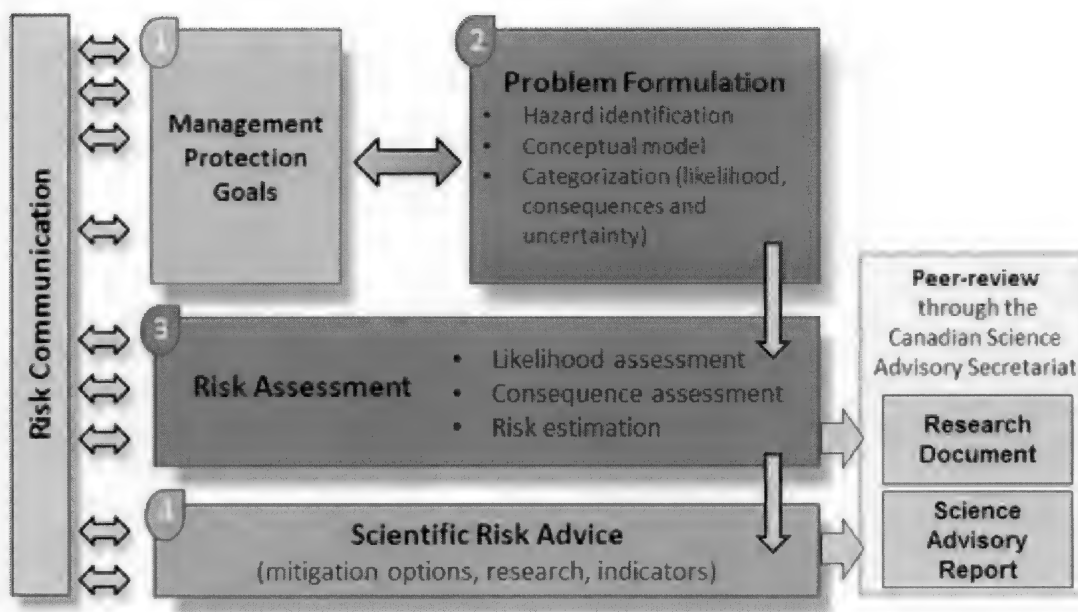
Previous DFO Risk Assessment work

Aquaculture Science Environmental Risk Assessment Initiative <http://www.dfo-mpo.gc.ca/aquaculture/sci-res/asera-eng.htm>. Date modified 2015-06-02. Accessed 2018-09-27

“Fisheries and Oceans Canada (DFO) has launched the Aquaculture Science Environmental Risk Assessment Initiative under the renewed Sustainable Aquaculture Program to support science-based decision-making with regards to aquaculture activities. The Initiative will synthesize data and information, incorporate expert opinion, and provide scientific advice through a series of environmental risk assessments of the potential aquaculture stressors on wild fish and the environment across the country.

The Aquaculture Science Risk Assessment Initiative builds on the 2009 Science Advisory Report Pathways of Effects for Finfish and Shellfish Aquaculture, which describes the potential linkages between aquaculture activities, environmental stressors and effects. Through this process, seven stressor categories were identified: physical alteration of habitat structure; alteration in light; noise; release of chemicals and litter; release or removal of nutrients, non-cultured organisms, and other organic material; release or removal of fish; and release of pathogens.

To ensure consistency throughout the Initiative, the Department has put in place the Aquaculture Science Environmental Risk Assessment Framework outlining the process and components of each assessment. The Framework (Figure 1) is aligned with international and national standards following a four-step process, and is enhanced by external scientific peer-review. This Framework will advance the delivery of systematic, structured, timely, transparent and comprehensive risk assessments.”



The framework was applied and reviewed in a subsequent CSAS process in December 2016: Assessment of the risk to Fraser River sockeye salmon due to Infectious Hematopoietic Necrosis Virus transfer from Atlantic salmon farms located in the Discovery Islands area, British Columbia. National Peer Review - National Capital Region and Pacific Region. December 5-8, 2016, Vancouver, BC.

- Terms of Reference http://www.dfo-mpo.gc.ca/csas-sccs/Schedule-Horraire/2016/12_05-08-eng.html.
- Science Advisory Report http://www.dfo-mpo.gc.ca/csas-sccs/Publications/SAR-AS/2017/2017_048-eng.html.
- Research Document (1/5 total) Mimeault, C., Wade, J., Foreman, M.G.G., Chandler, P.C., Aubry, P., Garver, K.A., Grant, S.C.H., Holt, C., Jones, S.R.M., Johnson, S.C., Trudel, M., Burgetz, I.J. and Parsons, G.J. 2017. Assessment of the risks to Fraser River Sockeye Salmon due to Infectious Hematopoietic Necrosis Virus (IHNV) transfer from Atlantic Salmon farms in the Discovery Islands of British Columbia. DFO Can. Sci. Advis. Sec. Res. Doc. 2017/075. vii + 75 p. http://www.dfo-mpo.gc.ca/csas-sccs/Publications/ResDocs-DocRech/2017/2017_075-eng.html

Other DFO risk assessment work of interest:

DFO. 2006. Assessing habitat risks associated with bivalve aquaculture in the marine environment. National Capital Region. Canadian Science Advisory Secretariat Science Advisory Report 2006/005

Bastien-Daigle, S., Hardy, M., Robichaud, G. 2007. Habitat management qualitative risk assessment: Water column oyster aquaculture in New Brunswick. Canadian Technical Report of Fisheries and Aquatic Sciences 2728.

O, M., Martone, R., Hannah, L., Greig, L., Boutillier, J., and Patton, S. 2014. An Ecological Risk Assessment Framework (ERAF) for Ecosystem-based Oceans Management in the Pacific Region. DFO Can. Sci. Advis. Sec. Res. Doc. 2014/072.vii + 59 p. <http://waves-vagues.dfo-mpo.gc.ca/Library/360156.pdf>

Thornborough, K., Dunham, J., O, M. 2016. Development of risk-based indicators for the SGaan Kinghlas-Bowie Seamount Marine Protected Area. DFO Can. Sci. Advis. Sec. Res. Doc. 2016/027. <http://waves-vagues.dfo-mpo.gc.ca/Library/363985.pdf>

Rubidge, E., Thornborough, K., O, M. 2018. Ecological Risk Assessment for the Effects of Human Activities on the SGaan Kinghlas-Bowie Seamount Marine Protected Area. DFO Can. Sci. Advis. Sec. Res. Doc. 2018/012. viii + 98 p.

Lawson, J. W., Lesage, V. 2012. A draft framework to quantify and cumulate risks of impacts from large development projects for marine mammal populations: A case study using shipping associated with the Mary River Iron mine project. DFO Can. Sci. Advis. Sec. Res. Doc. 2012/154. <http://waves-vagues.dfo-mpo.gc.ca/Library/348009.pdf>

Holt, K.R., Ackerman, B., Flemming, R., Forrest, R., Kronlund, A., Lacko, L., Rutherford, K., Workman, G.D., and Taylor, N. 2012. Ecological Risk Assessment for the Effects of Fishing: A Pilot Study for British Columbia Groundfish Fisheries. Canadian Technical Report of Fisheries and Aquatic Sciences. Vol 2990. <http://waves-vagues.dfo-mpo.gc.ca/Library/347602.pdf>

Minor revisions

p.3 states “In Canada, aquaculture is a relatively new industry...” Finfish aquaculture is relatively new, but shellfish aquaculture goes back more than 100 years on the Pacific coast. Additionally, First Nations have been using shellfish aquaculture for thousands of years.

INTEGRATED PEST MANAGEMENT MEETING

October 16, 2018

13:00 – 15:30

**Vancouver Island Conference Centre
101 Gordon Street, Nanaimo
Dodd Narrows Room B**

MEETING NOTES

Meeting Participants

DFO: Bernie Taekema, Zac Waddington, Sarah McConnachie, Adrienne Paylor, Anoma Patirana

Industry: [REDACTED] (BCSFA), [REDACTED] (BCSFA), [REDACTED] (Marine Harvest), [REDACTED] (Cermaq), [REDACTED] (Cermaq), [REDACTED] (Creative Salmon), [REDACTED] (Grieg), [REDACTED] (Grieg), [REDACTED] (Marine Harvest), [REDACTED] (Grieg), [REDACTED] (Cermaq)

BC MOE: Andreas WinsPurdy, Cassandra Caunce, Conrad Berube, Glen Okranitz, Jonathan Mullan

MEETING NOTES

Overview of Agenda and Meeting Objectives

- DFO noted that the key objectives of this meeting were to update industry on any recent changes to permits/authorizations and alternate treatment methods including the proposed changes to the provincial draft regulatory amendments to the Integrated Pest Management Regulation (IPMR).

Update on 2018 Sea Lice Trends

- DFO provided context for why IPM continues to be in the forefront of sea lice management. In 2018 Clayoquot Sound experienced sea lice management issues due to SLICE resistance that was largely brought on by environmental changes (failure of freshwater influence during the winter of 2017/2018), in combination with multiple year classes that lead to a threshold tipping towards resistance.
- Company vets shared their experiences with IPM and noted general concern with having limited tools for managing lice and emphasized the need for more treatment options.

- Creative Salmon indicated that they observed more sea lice for this stage in the summer of 2018.
 - Creative Salmon included anecdotal references to the same observation by commercial fisherman, who were catching salmon outside Clayoquot sound which shouldn't have been impacted by the lice management on farms in the area.
 - This indicates a regional trend toward increased lice numbers generally, independent of how lice were managed on farms.
- A Grieg representative referenced a situation in 2012 where an entire farm in Esperanza was fallowed for a generation due resistance brought on by one SLICE treatment. He further noted that when investigating the use of alternative treatment options such as Imvixa, Health Canada had requested for evidence of resistance/failure of two different treatments options prior to issuing an Emergency Drug Release (EDR) for another therapeutant.
 - This is problematic from an IPM perspective, and practically impossible given the reality of only one product (SLICE), being available in many areas on the coast.
- A Cermaq representative indicated that access to well boats is a major issue, noting reliance on generosity of others (Marine Harvest) for their boats. He further clarified that handling of fish as required for well boat and/or mechanical removal treatment options is dependent on environmental conditions, whereby poor conditions such as algal blooms can impede its use (handling of fish leads to their stress in these conditions)) therefore making the use of these treatment impractical and unethical in many circumstances.
- Industry representatives highlighted that what is of greatest importance is having access to tools that can be alternated. They do not wish to be rid of SLICE in the long term, but rather, want a suite of options.
- In particular, a MH representative stated that different tools for different times and different applications for different life stages are also important. Industry needs access to more treatment options which may be any or all of: mechanical removal, cleaner fish, husbandry practices, drugs or pesticides. .
- A Cermaq representative noted that one downside with peroxide use is that it requires additional treatments for juvenile fish. Smaller fish are less tolerant of lice but can handle significantly more than the COL threshold (3 motiles), without welfare concerns.
- It was also noted that given that there's a 60 day withdrawal on SLICE (for export to the US); therefore vets must make a decision on its use at least 3 months prior to harvest.

Pesticide Use Permit process and expectations

- BC MOE provided an overview of the current Provincial permitting process for pesticides:

- There are currently 10 aquaculture permits for peroxide use with 4 in the queue.
- The permits are valid for 3 years, with pesticide application permissible within the area specified by the permit.
- Public consultation is a significant aspect of the permitting process as is consultations with First Nations. There's a legislated timeline between when the industry notice is posted in the paper and when consultations are completed with the First Nations. Thus industry needs to carefully balance when they post their notice.
- The permitting process also has a quasi-judicial appeal board that aims to hear cases within a month. The board must first agree to hear a case (there have been instances where they have refused). The appeal board has a provision for mediation which can be time-saving.
- Under the IPM regulation there is an exemption clause for unforeseen pest problems (where public consultation can be avoided), however the bar for that is very high and would be for extraordinary situations. This is ultimately a cabinet decision and has not so far been used for aquaculture.
- In response to a question by an industry representative regarding the reasoning for considering peroxide as a pesticide when it breaks down fairly quickly to its individual elements (hydrogen and oxygen), BC MOE responded that this relates to the fact that product that is being applied is a pesticide and regarded as such by Health Canada.

Policy on Pesticide Use

- BC MOE provided an overview of the policy on pesticide use and proposed regulatory amendment process.
 - Policy development process has been initiated under IPM Act. The first step is to post a regulatory proposal for public consultation which will be open for 45 days.
 - Once that period is complete, the Ministry will review if any tweaks are needed and policy updates will be made.
 - The next step is involves working with legislative drafters to draft amendment to the Act which then goes to Cabinet, followed by queuing for legislative time.
 - Ministry staff is aiming to bring about the proposed revisions to the IPMR early in 2019.
- DFO (BT) pointed out that much of what is being proposed by the regulatory proposal in fact overlaps with DFO's jurisdiction and requested that there be a targeted meeting between DFO and BC MOE to further discuss.

ACTION: DFO to set up meeting with BC MOE to discuss IPM regulatory proposal

Regulatory amendments

- In March 2018 BC MOE released policy for permits for IPM. It was explained that aim of the proposal is to move the policy into the realm of regulations such that statutory decision makers are obligated to take particular actions for achieving desired environmental outcomes. The intent of the regulation is to use “close containment” or other technology to prevent release of pesticide into the environment. The regulations apply to all pesticides that might be employed to manage sea lice.
- Four actions for regulatory changes are being proposed:
 - The first change is clarifying that pesticide use in aquaculture requires a permit.
 - Second change is restricting application technology. Specifically requiring that aquaculture operators use a well boat for the application of pesticide to manage sea lice. This change also includes promoting use of best available of technology to minimize release of pesticides into the environment. Aquaculture facility operators may request substituting other “closed containment” application technology that prevents release of pesticide into the environment when conducting sea lice treatments. The term “closed containment” is not defined at this point purposefully so as to not dampen innovation. Regulation aims to be outcome based.
 - DFO (BT) queried what habitat/ecological information MOE uses to determine where a pesticide can be discharged in a licence assessment process, since DFO is in possession of that information. MOE noted that information is currently acquired by maps (which are not always accurate or up to date) but welcomed building in a referral process to flag these concerns to DFO.
 - The third change is an exception to the requirement for using of a well boat or other closed containment application technology only where this requirement would prevent the management of sea lice and result in a serious risk to wild salmon populations.
 - The fourth change is the provision of a year transition period for when regulatory change made to when it is implemented. BC MOE requested feedback from industry to better understand how onerous it will be for companies to coordinate well boat use, acquiring new ones etc.
- First week of December being targeted for any changes to the proposed regulatory amendment and February for a potential regulatory sign off.

ACTION: DFO to share referral contact with BC MOE.

Minor Use Minor Species program

- BCSFA provided an update on the recommendations arising from the federal government's Advisory Council on Economic Growth (also known as the “Barton Report”).

- As a result of Barton report cabinet set up economic tables (comprised of business leaders) to determine the economic barriers for aquaculture and agriculture.
- One of the recommendations arising from a table was to fund a committee to explore new products. Agriculture Canada seems receptive to this idea which is positive.

Next Steps

- All participants agreed that the meeting had been informative and the conversation should continue. This would facilitate continued collaboration between DFO and Industry to develop a holistic approach, which can be also be effectively regulated.
- The group agreed to meet twice a year. The next meeting would likely take place in the spring of 2019.

Waddington, Zac

From: [REDACTED]
Sent: October-17-18 5:37 PM
To: [REDACTED] Waddington, Zac
Subject: Re: Contact info
Attachments: Kreitzman et al. 2018 (SLICE-resistance evolution).pdf

Follow Up Flag: Follow up
Flag Status: Flagged

[REDACTED]

Zac, for context, I'm currently [REDACTED] at the biological station in Nanaimo. I'm also on the board of Salmon Coast Field Station, in the Broughton Archipelago, where [REDACTED] was working before he moved to the West Coast of the Island.

As [REDACTED] mentioned, over the last few years, I've been doing some work exploring the potential for SLICE resistance in BC sea lice. I'm attaching an example of work I've been involved with. In short, there's some theory from the plant-agricultural world that suggests wild salmon in BC may help resist the rapid rise of SLICE-resistance in BC.

Given recent sea-louse outbreaks in Clayoquot Sound, and reports of resistance there, I'd like to incorporate relevant information into my work. Would it be possible to get a few more details from you about this year's possible bouts of SLICE resistance? Ideally, I'd love to be able to access results of the bioassays that indicated resistance, but I'm not sure if those are available.

Thanks in advance,
[REDACTED]

On Wed, 17 Oct 2018 at 17:17, [REDACTED] wrote:
Hi Zac,

I am connecting you with a colleague [REDACTED]. He has been interested in slice resistance along with the influence of wild-type lice and other factors that may have altered the emergence of resistance in BC. I thought it may be good for you two to chat.

[REDACTED]

[REDACTED]

s.19(1)

On Fri, Sep 21, 2018 at 12:43 PM [REDACTED] wrote:
Hey Zac and Nathan,

Thanks for getting back to me. The best I can gather is that the province/DFO took part in the BAMP program in the Broughton Archipelago in the 2000's. The Nuuchahnulth TC fisheries and the Wild fish conservancy did juvenile salmon and sealice monitoring in 2004-2007 and 2009-2010 respectively and that more recently Cermaq has been contracting Ahousaht fisheries to conduct wild smolt sampling. Interesting

that DFO aquaculture was doing sampling in Esperanza I would be curious to hear how that went. Is there any information available on that program?

On Thu, Sep 20, 2018 at 4:44 PM Blasco, Nathan <Nathan.Blasco@dfo-mpo.gc.ca> wrote:
Mac and Zac,

DFO aquaculture management staff only started looking at Sealice on wild smolts a couple of years ago and it was not in Clayoquot Sound, only Esperanza Inlet in Nootka Sound. That is not to say it won't happen there in the future we will see. As for other DFO groups, I have no idea if there was anyone else doing that work, sorry. Howie may have done sealice/wild smolt work when he was with the province. In fact I am pretty sure he did but it may have only been in the Broughton, you'd have to ask him.

Nathan

Sent from my BlackBerry 10 smartphone on the Bell network.

From: Waddington, Zac
Sent: Thursday, September 20, 2018 3:29 PM
To: [REDACTED]
Cc: Blasco, Nathan
Subject: RE: Contact info

Hey sorry for my super delayed response! Your email got buried in a sea of others, and I forgot to get back to you until I stumbled upon it today. To answer your questions: I know DFO has conducted smolt sampling in Clayoquot in the past, but that was well before my time with DFO and I'm not sure of the outcome of that. If there was data from that I would have no issue sharing that since it's not part of the ongoing investigation taking place currently. I have cc'ed Nathan Blasco who is a biologist who has worked doing the beach seining in the past, he might be able to offer some insight???

Hope that helps, sorry I couldn't share more, as soon as I get the ok I'd be happy to provide you more details,

Zac

From: [REDACTED]
Sent: August-30-18 10:31 AM
To: Waddington, Zac
Subject: Re: Contact info

s.19(1)

Hey Zac,

Also just wondering, is there assay data available from past events in BC that would be available? Also did DFO ever conduct any wild juvenile salmon/ sealice assessments in Clayoquot Sound, if so is there data available from that? I was aware of assessments done in 2004-2007 and 2009-2010 by other parties but unsure if dfo ever did sampling or has available data.

Cheers,

On Thu, Aug 30, 2018 at 9:40 AM [REDACTED] wrote:

Hey Zac,

Not a problem. Thanks for letting me know.

Cheers,

On Thu, Aug 30, 2018 at 9:11 AM Waddington, Zac <Zac.Waddington@dfo-mpo.gc.ca> wrote:

I would be happy to share it with you; however my manager and director have concerns [REDACTED]

[REDACTED] So I'll have to wait to hear back what they say we can distribute. Sorry about that,

Zac

s.19(1)
s.21(1)(a)
s.21(1)(b)

From: [REDACTED]
Sent: August-29-18 2:45 PM
To: Waddington, Zac
Subject: Re: Contact info

Hey Zac,

I was wondering if I could actually see some of the assay data that is available.

Cheers,



On Wed, Aug 29, 2018 at 11:27 AM [REDACTED] wrote:

Hi Zac,

Thanks for calling yesterday, I really appreciate you reaching out and answering some questions.

Cheers,



On Tue, Aug 28, 2018 at 5:06 PM Waddington, Zac <Zac.Waddington@dfo-mpo.gc.ca> wrote:

Thanks very much for your ongoing work and interest in the ecology of Clayoquot. I am happy to try and answer whatever questions I can in the future.

s.19(1)

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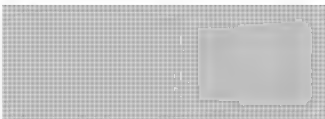
Cedar Coast Field Station



Cedar Coast Field Station



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Cedar Coast Field Station



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Cedar Coast Field Station



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Cedar Coast Field Station



Cedar Coast Field Station



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REVIEW

Wild Salmon Sustain the Effectiveness of Parasite Control on Salmon Farms: Conservation Implications from an Evolutionary Ecosystem Service

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Keywords

Ecosystem services, evosystem services, microevolution, population genetics, gene flow, pest management, chemical resistance, aquaculture, salmon, sea lice

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Received

3 February 2017

Accepted

10 July 2017

Editor

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doi: 10.1111/conl.12395

Abstract

Rapid evolution can increase or maintain the provision of ecosystem services, motivating the conservation of wild species and communities. We detail one such *contemporary evosystem service* by synthesizing theoretical evidence that rapid evolution can sustain parasiticide efficacy in salmon aquaculture, thus creating an added incentive for salmon conservation. Globally, wild and farmed salmon share native parasites, sea lice. In most major salmon farming areas sea lice have evolved resistance to parasiticides, but in the North Pacific, where farmed salmon coexist with large wild salmon populations, resistance has not emerged. We present a model to show that flow of susceptible genes from lice hosted on wild salmon to those hosted on farmed salmon can delay or preclude resistance. This theoretical and observational data suggests that wild salmon (both oceanic populations that function as a refuge and local migratory populations that connect this refuge to domesticated environments) provide an evosystem service by prolonging parasiticide efficacy. To preserve this service, aquaculture managers could avoid production quantities that exceed wild salmon abundances, and sustain wild salmon populations through regional and oceanic scale conservation. The evosystem service of resistance mitigation is one example of how a contemporary evolutionary process that benefits people can strengthen the case for conservation of intrinsically important wild species.

Introduction

The ecosystem services concept provides a utilitarian framework accounting for nature's contributions to human well-being (Daily 1997), thereby adding practical motivations on top of more traditional, intrinsic ones

for conserving species and ecosystems. Recently, authors have sought to explicitly integrate evolutionary thinking into the ecosystem services concept using the term *evosystem services*. Some have noted that historical evolution has generated the diversity of life and thus all ecosystem services (Faith *et al.* 2010), while others have focused on

**Pages 1252 to / à 1263
are withheld pursuant to section
sont retenues en vertu de l'article**

68(a)

**of the Access to Information Act
de la Loi sur l'accès à l'information**

Jones, Simon

From: Jones, Simon
Sent: Tuesday, October 23, 2018 1:38 PM
To: Higgins, Mark
Subject: RE: collaborative hatchery project approval

Categories: Yellow Category

Mark,

Brendan Connors (DFO at IOS) contacted me about my interest in being involved. I told him I wasn't interested.

Reasons:

- Naturally high variability in pink salmon returns combined with a high level of innate immunity to sea lice infections raised doubts in my mind about the scientific validity of this study.
- The most likely sea lice species encountered by pink salmon emerging into the Strait of Georgia will be *Caligus clemensi*. This is supported by data from Dick Beamish and myself and more recent data from Stewart Johnson. There is virtually no basis for a relationship between *Caligus* in the lower SoG and salmon farms that occur elsewhere on the coast.

Simon

From: Higgins, Mark
Sent: October-23-18 1:15 PM
To: Jones, Simon
Subject: Fw: collaborative hatchery project approval

Simon, have you heard anything about this? I can see why SEP would be apprehensive as it could put pressure on them to respond depending on outcomes. I am not familiar with residual protection time for lice, but also seems to me that fish would just pick up lice once in seawater. Thoughts?

Sent from my BlackBerry 10 smartphone on the Rogers network.

From: Kennedy, Eddy <Eddy.Kennedy@dfo-mpo.gc.ca>
Sent: Tuesday, October 23, 2018 4:46 PM
To: Whelan, Christie; Kreiberg, Henrik; Higgins, Mark; Holmes, John
Cc: Lowe, Carmel
Subject: RE: collaborative hatchery project approval

More of a fish health /seallice project, so Mark is best to respond to logistics, experimental design, and probability of success. I don't see why DFO Science needs to be involved.

From: Whelan, Christie
Sent: October-23-18 11:52 AM
To: Kreiberg, Henrik; Higgins, Mark; Holmes, John; Kennedy, Eddy
Cc: Lowe, Carmel
Subject: collaborative hatchery project approval

Hi guys –

I'm looking for some advice on how to handle a request that has come across my desk.

Sean Godwin (recent PhD grad from John Reynolds lab at SFU) has NSERC funding for a project he is working on as part of his post-doc (in Jeff Hutchings lab at Dalhousie). Essentially, the project would be to treat pink salmon with SLICE in a hatchery environment before they are released, and then monitor their survival compared to a control group to determine if treating in the hatchery provides better survival in the marine environment. I am grossly over-simplifying this.

Overall, the pink salmon enhancement program from the Nanaimo hatchery seems to be the best location for this. It's a community run hatchery and my understanding is that Sean already has the community and Snuneymuxw First Nation support for the program, but that SEP has been pushing back. The reasons SEP has given for pushing back seem to all be about optics (e.g. what if the results indicate that SEP should change their practices) and not about the science or the health of the fish. SEP also said they want Science to indicate that we support this. South Coast has expressed they are not willing to put any resources into this, however Sean indicated that he does not need any DFO resources, only access to the hatchery.

My understanding is they tried to reach out to Simon Jones over the summer as well, but weren't able to connect with him. I think Sean is hoping to discuss the project with him, and see if Simon would like to be involved or has suggestions for improvement.

Overall, this seems to be a possible collaboration between SEP, Science, academia, and the local First Nation, for which we would not need to contribute any resources (which is a direction we've been talking about a lot!). Sean has also indicated that he would be very happy to explore other research questions with Science/SEP/Aquaculture management that could further advance some of the departmental questions/objectives. But I have hit a wall in trying to discuss this with SEP and South Coast.

So... I'm at a loss on how to help them move this forward right now. It seems that they took a circuitous route around the Department which has led to some confusion, but I am unaware if there is a proper communication chain for requests like this. I would like to be able to help them move to a point where they can move forward, or get a "no". Right now they just seem to be in limbo.

I've suggested that Sean review the minister's mandate letter and departmental results framework to ensure that the work is aligned the Departmental priorities, and provide a budget table that shows where all the resources for the project would be coming from (i.e. that there is no cost to DFO). And that I would chat with our Science management team to see what the best route for this to move forward is.

What are your thoughts on what appropriate review and approval channels are for this? This conversation has apparently been going on since last winter/early spring, so it would be nice to be able to move it forward.

Thanks.

Christie Whelan

Senior Science Advisor – Strategic Planning | Conseillère scientifique principale – planification stratégique
Fisheries and Oceans Canada | Pêches et Océans Canada
Pacific Biological Station | Station biologique du Pacifique
3190 Hammond Bay Rd, Nanaimo, BC, V9T 6N7, Canada
(250) 729-8383 | Christie.Whelehan@dfo-mpo.gc.ca

Waddington, Zac

From: Gautam, Raju (CFIA/ACIA) <raju.gautam@canada.ca>
Sent: October-24-18 6:06 AM
To: Waddington, Zac
Cc: Bruneau, Nathalie (CFIA/ACIA); McConnachie, Sarah; Sandberg, Krista
Subject: RE: Follow up

Hi Zac,

That sounds wonderful. I would definitely love to see the work completed. I am available today from 2 pm, tomorrow and the day after from 1 pm Ottawa time.

And congratulations Sarah on your new job, hope you will enjoy working with Zac's group.

I will be interested to hear about the hiring process for epidemiologist during the call.

Have a wonderful day.

Cheers,

Raju

From: Waddington, Zac [mailto:Zac.Waddington@dfo-mpo.gc.ca]
Sent: 2018-10-23 6:37 PM
To: Gautam, Raju (CFIA/ACIA)
Cc: Bruneau, Nathalie (CFIA/ACIA); McConnachie, Sarah; Sandberg, Krista
Subject: RE: Follow up

Hello again Raju! I apologize for the long pause in my communication, I've been busy running a few hiring processes and trying to keep somewhat on top of the other aspects of my job. But the good news is that we have hired a new veterinarian, Sarah McConnachie who has begun working with us, and we are very close to finishing the hiring of an epidemiologist.

I was hoping to pick back up the SLICE Resistance risk factors project that we began months ago, and I've asked Sarah if she would be interested in being the point person with this.

we figured she would be a good person to do more of the science related liaising for our department.

I was hoping to set up a time to have a call with yourself (and whomever else at CFIA), Sarah and me to discuss the next steps of this project. I agree with what Pascale said about this being a good project to try and ultimately publish, but at the very least I would like to complete the model building and see how valid it is based on our historic data.

Could you please let me know when might work for us to schedule a call,

Zac

From: Gautam, Raju (CFIA/ACIA) [mailto:raju.gautam@canada.ca]
Sent: July-26-18 6:02 AM
To: Waddington, Zac; Sandberg, Krista; Keith, Ian
Cc: Bruneau, Nathalie (CFIA/ACIA)
Subject: RE: Follow up

s.19(1)

I can wait until I get all the data. If you would like, I can even wait until you are able to obtain environmental data. There is no pressure on my side.

Thank you.

Raju

From: Waddington, Zac [mailto:Zac.Waddington@dfo-mpo.gc.ca]
Sent: 2018-07-25 5:11 PM
To: Sandberg, Krista; Gautam, Raju (CFIA/ACIA); Keith, Ian
Cc: Bruneau, Nathalie (CFIA/ACIA)
Subject: RE: Follow up

Thanks a bunch Krista. I think that if the PFMA data is aggregated over both 3.3 and 3.4 FHZ's then that should be fine to leave that lumping in our own inventory data given that we assume they will both clearly be "high spillover" areas in our model. At some point it would be excellent to get the 2011 and 2012 data, but I fully recognize how busy you are and I'll leave it up to you to tackle that when you have time. Raju, is there any time pressure on your end regarding getting this data? Or are you able to pause your work pending this data?

Zac

From: Sandberg, Krista
Sent: July-25-18 1:46 PM
To: Waddington, Zac; Gautam, Raju (CFIA/ACIA); Keith, Ian
Cc: Bruneau, Nathalie (CFIA/ACIA)
Subject: RE: Follow up

We have inventory data for 2011 and 2012 but it has not been summarized as it was not managed by me back then. It would take some effort to pull the data from individual reports, and I don't have the time to do this right now.

3.3 and 3.4 were combined because current breakdown is by PFMA area, not fish health zone and Area 12 includes both 3.3 and 3.4. Again, these could be broken down but would take a bit of effort – not much extra for this one, but I just can't get to it right now...

Krista.

Krista Sandberg
Office | Bureau 250-286-5835
Cellular | Cellulaire [REDACTED]



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From: Waddington, Zac
Sent: July-25-18 1:18 PM
To: Sandberg, Krista; Gautam, Raju (CFIA/ACIA); Keith, Ian
Cc: Bruneau, Nathalie (CFIA/ACIA)
Subject: RE: Follow up

Thanks so much Krista! Do we have inventory data for 2011 and 2012 by any chance? And I'm wondering if we could break out 3.3 and 3.4. Or did you combine them because the wild escapement data is lumped as well?

Zac

From: Sandberg, Krista
Sent: July-25-18 12:15 PM

s.16(2)(c)

To: Waddington, Zac; Gautam, Raju (CFIA/ACIA); Keith, Ian
Cc: Bruneau, Nathalie (CFIA/ACIA)
Subject: RE: Follow up

2013-2017 Inventory attached

Krista Sandberg
Office | Bureau 250-286-5835
Cellular | Cellulaire [REDACTED]



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From: Waddington, Zac
Sent: July-25-18 11:16 AM
To: Gautam, Raju (CFIA/ACIA); Sandberg, Krista; Keith, Ian
Cc: Bruneau, Nathalie (CFIA/ACIA)
Subject: RE: Follow up

Thanks again for all your help Raju. Krista is putting together an average inventory for all farms in a given zone from June-end of Dec. for each year. So you will have only one number to compare to the wild escapement data. I am still trying to get a hold of the environmental data, but if that can't be done before you exhaust your allocated time then so be it.

Zac

From: Gautam, Raju (CFIA/ACIA) [mailto:raju.gautam@canada.ca]
Sent: July-25-18 11:10 AM
To: Waddington, Zac; Sandberg, Krista; Keith, Ian
Cc: Bruneau, Nathalie (CFIA/ACIA)
Subject: RE: Follow up

Hi Zac,

Thank you for sending this. And I assume you are going to send the inventory data that has the actual number of fish in the farm? I will work on this request once I have complete data including the inventory data that is yet to come. I have discussed work related to this request with my Manager, Nathalie Bruneau (copied in this email) and she has kindly approved me to dedicate the time required to complete this (± 2 days). In the event there is a need for further analysis, I will be happy to pass on the final data and provide explanation for all that was done to the person that takes it on and continue to engage on this project to provide input and consultation.

Thank you.
Raju

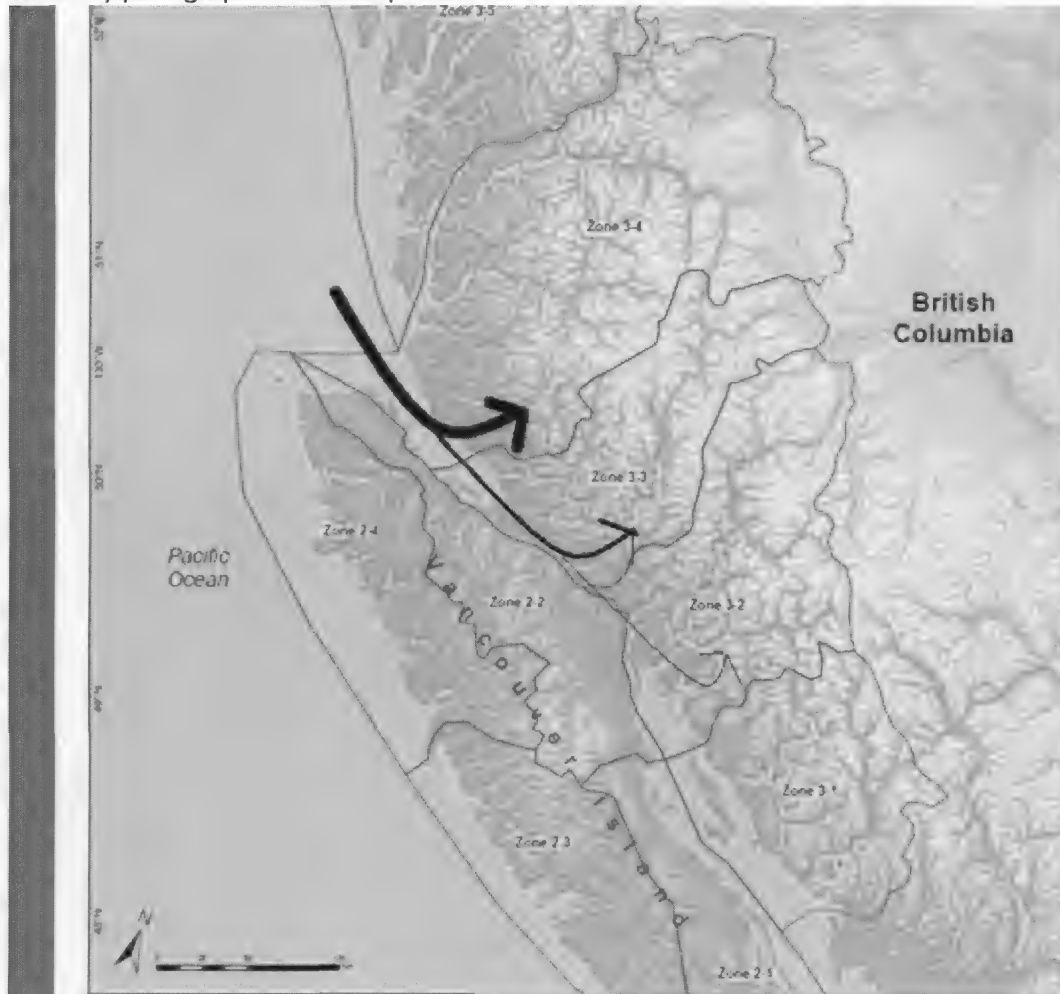
From: Waddington, Zac [mailto:Zac.Waddington@dfo-mpo.gc.ca]
Sent: 2018-07-24 2:45 PM
To: Gautam, Raju (CFIA/ACIA); Sandberg, Krista; Keith, Ian
Subject: Follow up

Sorry for the delay, we had a major IT crash which knocked our email down for Friday and much of the weekend, and then I was out of the office yesterday. But to follow up on what I said I was going to do:

1. Rule for how to allocate wild fish returns to Fish Health Zones 3.4, 3.3 and 3.2:
 - a. The assumption being made is that all fish returning to zones 3.4, 3.3 and 3.2 do so from the north through the Queen Charlotte Strait. Therefore, all fish that return to FHZ 3.2 will be assumed to have a spillover effect on all zones they pass through during their migration back to their natal streams.

- i. Therefore, the wild fish return numbers for FHZ 3.2 will solely be those that return to streams within FHZ 3.2
- ii. The wild fish return numbers for FHZ 3.3 will include all wild fish that return to streams within FHZ 3.2 or 3.3
- iii. The wild fish return numbers for FHZ 3.4 will include all wild fish that return to streams within FHZ 3.4, 3.3 or 3.2

This very poor graphic make help make sense:



2. I think the best rule to try and measure the risk of SLICE resistance as a function of multiple treatments on one cohort of fish at a farm would be to first break each farm(s) into pre- and post- SLICE resistance eras. Given that treatment with SLICE would/should have changed drastically after the development of resistance, I think it's vital that we make that division in the data. I am still waiting to hear back from Marine Harvest on the quarter in which they first identified resistance in Klemtu and Quatsino. But I think that if we simply identify the quarter in which resistance emerged in farm or zone, then we can treat all quarters previous as "pre-SLICE resistance era" and all quarters following as "post-SLICE resistance era."

To arrive at the best measure of repeated SLICE use, on a given fish, at a given farm, over time; I suggest we use the formula:

$$\# \text{ of treatments} \div \text{given cohort} \# \text{ of cohorts at farm site in either pre-or post-resistance era} = X$$

The other potential variation would be to try and factor in how many cohorts we present at the farm relative to months of activity. Since some sites may have had cohorts of fish present for less than a full production cycle (i.e. smolt entry sites). In that case the formula could look something like:

of treatments ÷ given cohort # of cohorts at farm site in either pre-or post-resistance era months active in either pre-or post-resistance era = X

Totally open to suggestions.

Zac

Dr. Zac Waddington DVM, B.Env.Sc.(Hons)

Lead Veterinarian - Pacific Region

Fisheries and Oceans Canada | Pêches et Océans Canada

Aquaculture Environmental Operations - Fish Health

Courtenay, British Columbia

Telephone | Téléphone: 250-703-0902

Fax | Télécopieur: 250-703-0921

Zac.Waddington@dfo-mpo.gc.ca

Waddington, Zac

From: messenger@webex.com
Sent: October-26-18 9:46 AM
To: Waddington, Zac
Subject: Meeting reminder: SLICE resistance project

****La version française suit****

You are scheduled to host this online meeting.

Topic: SLICE resistance project
Date: Friday, October 26, 2018
Time: 10:00 am, Mexico Pacific Daylight Time (Tijuana, GMT-07:00)
Meeting Number: 552 028 540
Meeting Password: [REDACTED]
Host Key: [REDACTED]

To start the online meeting

1. Go to <https://pwgsc-nh.webex.com/pwgsc-nh/j.php?MTID=mac2108e84d4c4601b950c88788953a97>
2. Log in to your account.
3. Click "Start Now".
4. Follow the instructions that appear on your screen.

Teleconference information

Provide your phone number when you join the meeting to receive a call back. Alternatively, you can call:
Call-in toll-free number: 1-877-413-4781 (Canada)
Call-in number: 1-613-960-7510 (Canada)
Host access code: [REDACTED]
Attendee access code: [REDACTED]

To check whether you have the appropriate players installed for UCF (Universal Communications Format) rich media files,
go to <https://pwgsc-nh.webex.com/pwgsc-nh/systemdiagnosis.php>

For assistance

1. Go to <https://pwgsc-nh.webex.com>
2. On the left navigation bar, click "Support".
3. Call 1-800-226-6338 or 613-941-9554

s.16(2)(c)

Selon le programme, vous organiserez cette réunion en ligne.

Sujet : SLICE resistance project
Date : Friday, October 26, 2018
Heure : 10:00 am, Mexico Pacific Daylight Time (Tijuana, GMT-07:00)
Numéro de la réunion : 552 028 540
Mot de passe de la réunion : [REDACTED]
Code organisateur : [REDACTED]

Pour commencer la réunion en ligne

1. Allez sur le site <https://pwgsc-nh.webex.com/pwgsc-nh/j.php?MTID=mac2108e84d4c4601b950c88788953a97>
 2. Connectez-vous à votre compte.
 3. Cliquez sur « Commencer maintenant ».
 4. Suivez les instructions à l'écran.
-

Informations sur la téléconférence

Provide your phone number when you join the meeting to receive a call back. Alternatively, you can call:

Call-in toll-free number: 1-877-413-4781 (Canada)

Call-in number: 1-613-960-7510 (Canada)

Host access code: [REDACTED]

Attendee access code: [REDACTED]

Pour lier des fichiers rich media au format UCF, vous devez disposer de lecteurs compatibles. Vérifiez que votre ordinateur possède les lectures adéquats en accédant à <https://pwgsc-nh.webex.com/pwgsc-nh/systemdiagnosis.php>

Pour obtenir de l'aide

1. Allez sur le site <https://pwgsc-nh-fr.webex.com>
2. Dans la barre de navigation, à gauche, cliquez sur Assistance.
3. Composez numéro sans frais: 1-800-226-6338 ou 613-941-9554

s.16(2)(c)

Waddington, Zac

From: Paylor, Adrienne
Sent: October-29-18 12:37 PM
To: Waddington, Zac
Cc: Tomlinson, Daniel
Subject: FW: Cermaq Clayoquot Sea Lice.
Attachments: Investigation Request Form Final Sep 27 2012.docx

Follow Up Flag: Follow up
Flag Status: Completed

Hi Zac,

I just met with Dan and it looks like you will be the main contact to get this review started. Dan has asked that you attempt to fill out this attached form and to give him a call if you have any questions. I'm sure you will have to meet face to face a few times on this one.

Thanks,
Adrienne

From: Tomlinson, Daniel
Sent: October-26-18 1:33 PM
To: Paylor, Adrienne
Cc: Plummer, Greg
Subject: Cermaq Clayoquot Sea Lice.

Adrienne,



The form asks for details of correspondence. This would include all correspondence between AMD and Cermaq from the time that DFO became aware of the issue and internal DFO correspondence for the same period.

I am not sure how many staff are involved. Perhaps a quick chat on Monday before forwarding to the relevant parties?

Cheers, Dan

s.21(1)(a)
s.21(1)(b)



AMD / AEO / ARM REQUEST FOR INVESTIGATION BY CONSERVATION & PROTECTION

*All requests should only be forwarded based on the AMD / C&P Compliance Protocol. This form pertains to violations observed as a result of a site inspection / personal observation / Reports submitted by industry or on-going non-compliance issues with a particular facility or company. Public complaints that are received that are a Level 3 and 4 in the compliance matrix shall be forwarded directly to C&P.

1.0 DETAILS OF INDIVIDUAL SUBMITTING REQUEST

Name: _____ Position: _____

Office Address: _____

Office Telephone Number: _____

Cell Phone Number: _____

Fax #: _____ Date Submitted to C&P: _____

2.0 DETAILS OF ACCUSED

Is the site/company a Freshwater, Marine Fin Fish or a Shellfish Site? FW ☐ MFF ☐ SF ☐

Company Name: _____

Aquaculture Facility Reference #: _____

Site Location: _____

Company Contact Information:

Name: _____ Position: _____

Telephone Number: _____ e-mail: _____

"PROTECTED B" when completed.

Revised date: 2018/01/22

3.0 DETAILS OF ALLEGED VIOLATION

Is the alleged violation under the Pacific Aquaculture Regulations, the Facilities Licence Conditions or other legislation?

☐ PAR Section(s): _____ ☐ Licence Conditions Sections : _____

☐ Other Legislation : Name of Legislation : _____ Section(s): _____

Based on the compliance protocol is the alleged violation a Level 1 (low risk) ☐ Level 2 (Minor risk) ☐ Level 3 (Moderate risk) ☐ Level 4 (Significant risk) ☐ for PAR and Licence Condition violations.

If it is a level 1 or 2 please provide details in Section 4.0, i.e. the company has been issued two non-compliance letters with respect to this issue in the past or this has been identified to the owner/operator and to date nothing has been done to come into compliance.

4.0 DETAILED CIRCUMSTANCES

Add circumstances as a separate word document and attach to request. Use Arial 12 font.



PlummerG

2012-09-27 18:48:41

Please describe in as much detail as possible and relevant to the alleged violation of what occurred. The narrative must be laid out in a chronological manner summarizing details of the event. If evidence was collected at the time of the event

5.0 LIST OF PHOTOGRAPHS (Photographs must be submitted and labelled with request)

Photograph #	Date Taken	Taken By	Description of Photograph
1			
2			
3			
4			
5			
6			
7			
8			
9			

6.0 LIST OF CORRESPONDENCE (Letters, e-mails, telephone conversations)

Correspondence type Letter: L E-mail: E Telephone: T Other: O	Date	Description of Correspondance (i.e. Non-compliance letter, e-mail etc.) *Include who it was sent to and by etc. *All correspondence and notes of conversations must be submitted with request.
		PlummerG 2012-09-27 18:49:37 e-mail to John Smith of company X from Y requesting a, b and c etc.

"PROTECTED B" when completed.

Revised date: 2018/01/22

7.0 OTHER RELEVANT INFORMATION

*Include any and all other relevant information with respect to the violation (i.e. legal sampling information, inspection forms completed on-site, industry submitted reports, relevant background information of company's compliance history etc.

Item #	Date	Description

8.0 WITNESS DETAILS

Witness # 1

Name: _____ Position: _____

Office Address: _____

Office Telephone Number: _____

Cell Phone Number: _____ e-mail: _____

Can – Say: Add can-say as a separate word document and attach to request. Use Arial

PlummerG

2012-09-27 19:01:27

Can – Say: (Example) (Use Arial 12 Font)

That on September X, 2012
Fishery Guardian John SMITH
conducted an inspection of (Compa
name, site name, Aquaculture licenc
#) located in Charlie's Cove on Quar

For witnesses that are non-departmental employees please provide name and contact information.

"PROTECTED B" when completed.

Revised date: 2018/01/22

Witness # 2

Name: _____ Position: _____

Office Address: _____

Office Telephone Number: _____

Cell Phone Number: _____ e-mail: _____

Can – Say: Add can-say as a separate word document and attach to request. Use Arial

PlummerG

2012-09-27 18:52:25

Can – Say: (Example) (Use Arial 12
Font)

That on September X, 2012
Fishery Guardian John SMITH
conducted an inspection of (Compar
name, site name, Aquaculture licenc
#) located in Charlie's Cove on Quai

9.0 MANDATORY ATTACHMENTS

1. Copy of hand written notes with transcription (if illegible) of all witnesses
2. Copies of all correspondence (Letters, e-mails etc.) *if applicable*
3. Copy of R.O.V. video Data *if applicable*
4. Copies of all photographs *if applicable*
5. Copies of Legal sample reports *if applicable*
6. Witness information and Can-says
7. Copy of Aquaculture Licence and any and all amendments to the licence
8. Compliance History (i.e. all previous compliance letters and information) *if applicable*
9. Completed Inspection Forms *if applicable*
10. Copy of ITC Licence *if applicable*
11. Copy of Broodstock Licence *if applicable*
12. Copy of Inspector's Direction issued *if applicable*
13. Impact Statement *if requesting a prosecution. If an investigation results in a prosecution an impact statement will be required.*
14. Copy of GPS information taken and any maps that were developed showing tenure boundaries, location of violation etc. *if applicable*

*Please attach any and all information that you believe is relevant that is not covered by this form.

~~Requests are to be submitted to C&P Aquaculture Field Supervisors and cc Detachment Supervisor.~~

If the mandatory attachments are not submitted or information in the request is not complete, Conservation & Protection may return your request seeking further information. If you do not have access to the information or it is not applicable to the request please put N/A or contact C&P for clarification.

Any and all information that you submit may be used in a prosecution, please ensure that all information is stored and catalogued appropriately.

10.0 CONSERVATION & PROTECTION REQUEST RESPONSE DETAILS

Date Received: _____ Received By: _____

Is the request complete, including all the relevant information and

Mandatory attachments:

Y ☐ N ☐

If no, list missing information:

Date request sent back requesting further information: _____

If yes, is an investigation being initiated?:

Y ☐ N ☐

Assigned Investigator: _____ Date assigned: _____

If an investigation is not being initiated please detail rationale:

Requests are to

Date response reviewed by Supervisor: _____ Name: _____

"PROTECTED B" when completed.

Revised date: 2018/01/22

Does Supervisor agree with response:

Y ☐ N ☐

If no, provide details:

Date response sent to person initiating request: _____

Action Taken: _____

DVS #: _____

Fishery Officer Name: Name _____

Signature: _____

Date: _____

Field Supervisor Name: Name _____ Signature: _____

Date: _____

Detachment Supervisor Name: Name _____ Signature: _____

Date: _____

Response to initiator of request to be returned within 15 business days of receipt.

Date initiator of request notified: _____

"PROTECTED B" when completed.

Revised date: 2018/01/22

Rainer, Michelle

From: Waddington, Zac
Sent: October-29-18 3:00 PM
To: Rainer, Michelle; Tomlinson, Daniel
Subject: RE: For approval: Cermaq sea lice

Cermag has not voluntarily halted production at any site to my knowledge. They did voluntarily revoke their ASC certification for numerous sites. Perhaps this is what you're referring to?? They have begun to restock Clayoquot North sites, beginning with the most northerly sites, which have been fallowed longest. All smolts being entered into Clayoquot have been treated in the hatchery with a drug which prevents lice recruitment for 6-9 months. They have a hydrolicer scheduled to arrive in the early spring, in time for the outmigration window 2019.

Zac

From: Rainer, Michelle
Sent: October-29-18 1:37 PM
To: Waddington, Zac; Tomlinson, Daniel
Subject: For approval: Cermaq sea lice
Importance: High

Hi Zac and Dan,

How is this? Zac, I just need to know which sites have halted production, and whether that's a good way to word it.

Thanks,
Michelle

Issue: [REDACTED] CBC Victoria [REDACTED] I understand Cermaq euthanized the fish at its Fortune Channel farm on the west coast of the island despite using a pesticide in the summer to deal with sea lice. My colleague did some reporting at the time that DFO was investigating the management of sea lice at Cermaq Canada farms in Clayoquot Sound to determine if there has been non-compliance with the licence conditions. Has that investigation wrapped up? If so, what were the findings?

Deadline: Monday, October 29, 2:30 p.m.

Approved by:

Media lines:

- Cermaq Canada has voluntarily halted production at [which site, or sites?] in the Clayoquot area due to concerns about sea lice. **new**
- Earlier this year, Fisheries and Oceans Canada (DFO) collected sea lice from Cermaq Canada's Bawden site in the Clayoquot area and sent them to the BC Centre for Aquatic Health Sciences for analysis, which confirmed SLICE resistance. The Department also initiated a review, which is still ongoing, of Cermaq Canada's sea lice management practices at these farms to determine if relevant licence conditions have been followed appropriately. **approved**
- SLICE is approved for use in Canada as an in-feed therapeutant used by the salmon aquaculture industry to manage sea lice. It can only be administered to farmed fish under veterinary prescription. **approved**

- During most years, more than 90% of sites in BC are below the regulatory thresholds for sea lice during the wild salmon outmigration period (from March 1 to June 30 of each year). However, there were documented failures of SLICE treatment at Klemtu in 2015 and Esperanza Inlet in 2017 and now Clayoquot Sound in 2018. **approved**
- DFO is keeping a close eye on the issue of SLICE resistance. We have sent the lice collected at Bawden to researchers at the Atlantic Veterinary College, who are undertaking work to better understand the genetic basis for SLICE resistance. **approved**
- Research is under way, by DFO, industry, and academia, to find alternative methods to manage sea lice, and to better predict and track SLICE resistance. For instance, DFO is currently studying and supporting research on the use of Pacific perch as “cleaner fish” that eat sea lice off farmed fish and warm water baths to kill sea lice. More information on these projects can be found at www.dfo-mpo.gc.ca/aquaculture/sci-res/rd-eng.htm **approved**
- DFO is also supporting the licensing and approval process for alternative sea lice treatments, which are a necessary part of an integrated pest management approach. **approved**

Waddington, Zac

From: [REDACTED]
Sent: October-30-18 10:24 AM
To: Rainer, Michelle; Waddington, Zac
Subject: RE: Interview today
Attachments: Lice report final.pdf

Hi Michelle and Zac,

Thanks for connecting us Michelle. Both emails should come to the same place (let me know if you get a bounce back though on the [REDACTED] address!)

Zac, my afternoon is pretty open at the moment. Is there a time that works best for you?

I'm attaching a report released today by the Living Oceans Society that I'm hoping we can chat about as well this afternoon.

Thanks!

[REDACTED]

[REDACTED]
The Star Vancouver
[REDACTED]

Read my stories [here](#).

From: Rainer, Michelle <Michelle.Rainer@dfo-mpo.gc.ca>
Sent: October 30, 2018 10:21 AM
To: Waddington, Zac <Zac.Waddington@dfo-mpo.gc.ca>; [REDACTED]
Subject: RE: Interview today

Sorry, I think I gave an old email address [REDACTED] Zac, please use her [REDACTED] address.

From: Rainer, Michelle
Sent: October-30-18 9:59 AM
To: Waddington, Zac; [REDACTED]
Subject: Interview today

Hi Zac and [REDACTED]

Passing on your contact info so that you two can set up a good time to speak this afternoon.

Zac's number is (250) 703-0902

[REDACTED] can be reached at:

O: 
C: 

Cheers,

Michelle Rainer

Communications Advisor | Conseillère en communications

Fisheries and Oceans Canada | Pêches et Océans Canada

200 - 401 Burrard Street, Vancouver, B.C. V6C 3S4 | 200 - 401 rue Burrard, Vancouver, C.-B. V6C 3S4

Telephone | Téléphone 604-775-5065

s.19(1)

Rainer, Michelle

From: Waddington, Zac
Sent: October-30-18 10:44 AM
To: Rainer, Michelle; Jones, Simon
Subject: RE: Media inquiry on sea lice report

I would just make a few minor changes as below in red.

Zac

From: Rainer, Michelle
Sent: October-30-18 10:39 AM
To: Waddington, Zac; Jones, Simon
Subject: RE: Media inquiry on sea lice report

Thanks, Zac. Looks good. I was thinking we should add a line that SLICE is, in general, still an effective treatment in BC. This is all previously approved. Can we use it here?

SLICE and hydrogen peroxide treatments:

- Salmon farming companies use an in-feed therapeutant called SLICE (emamectin benzoate) to reduce lice abundance.
- In British Columbia to date, SLICE has generally been a very effective tool in the management of sea lice at salmon farms.
- To ensure that risk of louse resistance to SLICE is minimized, farms will rotate SLICE use with hydrogen peroxide.
- Hydrogen peroxide is widely used on Canada's east and west coast, and elsewhere in the world to remove sea lice from cultured fish. This pesticide is not absorbed by the fish and is non-toxic to humans. It also dissipates as a neutralized substance quickly in the environment, causing no discernible far-field effect
- The large reservoir of lice on wild salmon, which seasonally infests farmed fish, provides a large population of lice which are naive to any sea lice treatments. This has prevented the onset of widespread resistance to various treatments as has been seen elsewhere in the world.

From: Waddington, Zac
Sent: October-30-18 10:35 AM
To: Rainer, Michelle; Jones, Simon
Subject: RE: Media inquiry on sea lice report

I am willing to chat with folks if they wish. Please see my edits below in red. One of the previously approved media line about resistance in Klemtu needs to be updated. Resistance in fact was first noted in 2013, with exceedances during the 2013 outmigration.

Zac

From: Rainer, Michelle
Sent: October-30-18 10:16 AM
To: Waddington, Zac; Jones, Simon
Subject: Media inquiry on sea lice report
Importance: High

Hi Zac and Simon,

Living Oceans [REDACTED] released a report on sea lice and SLICE resistance in the Clayoquot today:

<https://livingoceans.org/action/sea-lice-out-control>

We have one media request from the Vancouver Sun and will likely receive more. I think I have lines approved already that will work, but just need a few details filled in. Zac, do these work from your perspective? Simon, can you please provide any pertinent information on environmental conditions in Clayoquot this year?

Thanks for your help,
Michelle

- Seasonal and year-to-year variations in ocean salinity, temperature and other environmental conditions are known to influence the abundance of naturally occurring sea lice. **approved**
- In Clayoquot sound over the past year.... What have conditions been like? Is the water exceptionally warm now? Or have there been other environmental factors that might have contributed to high lice numbers?
- Over the winter of 2017-2018, there was not the typical drop in salinity in Clayoquot which typically comes with winter rains. The resulting higher salinity resulted in increased lice production in the region and exacerbated the lice levels on farms.
- DFO is keeping a close eye on the issue of SLICE resistance. The Department collected sea lice from Cermaq Canada's Bawden site in the Clayoquot area and sent them to the BC Centre for Aquatic Health Sciences for analysis which confirmed SLICE resistance. Those lice were later sent to researchers at the Atlantic Veterinary College who are undertaking work to better understand the genetic basis for SLICE resistance. **approved**
- During most years, more than 90% of sites in BC are below the regulatory thresholds for sea lice during the wild salmon outmigration period (from March 1 to June 30 of each year). However, there were documented failures of SLICE treatment at Klemtu in 2013 and Esperanza Inlet in 2017 and now Clayoquot Sound in 2018. **approved**
- Research is under way, by DFO, industry, and academia, to find alternative methods to manage sea lice, and to better predict and track SLICE resistance. For instance, DFO is currently studying, or supporting research on, the use of Pacific perch as "cleaner fish" that eat sea lice off farmed fish and warm water baths to kill sea lice. More information on these projects can be found at www.dfo-mpo.gc.ca/aquaculture/sci-res/rd-eng.htm **approved**
- DFO is also supporting the licensing and approval process for alternative sea lice treatments, which are a necessary part of an integrated pest management approach. **approved**

From: [REDACTED]
Sent: October-30-18 6:19 AM
To: DFO.F PAC RHQ Media / Médias QGR PAC F.MPO
Subject: sea lice report

s.19(1)

Good morning,

Can someone please call me ASAP this morning to address a report from Living Oceans that claims the DFO knew as early as 2014 that resistance was developing in sea lice but did not take measures to protect wild juvenile salmon.

Thanks,



Reporter, Van Live
Vancouver Sun | The Province
#400 – 2985 Virtual Way
Vancouver, BC V5M 4X7

Phone: [REDACTED] Mobile: [REDACTED]

Twitter: [REDACTED]



The Province

 POSTMEDIA

The information contained in this email is strictly confidential, and is only intended for the party(ies) to whom it is addressed. Any other use, dissemination, distribution, disclosure or copying is prohibited. If you have received this email in error please so advise by reply email. Thank you.

s.19(1)

Rainer, Michelle

From: Webb, Allison
Sent: October-30-18 10:54 PM
To: Thomson, Andrew; Rainer, Michelle; Girouard, Louise
Cc: Bate, Dan; Reid, Rebecca
Subject: RE: FOR URGENT APPROVAL: Sea Lice story

Yes will do.

Allison Webb, Director / Directrice
Aquaculture Management / Gestion de l'aquaculture
Fisheries Management Branch / Direction de la gestion des pêches
Fisheries and Oceans Canada / Pêches et Océans Canada
200 - 401 Burrard St / Rue Burrard, Vancouver BC / C.B. V6C 3S4 Canada
604-666-7009
Allison.webb@dfo-mpo.gc.ca

From: Thomson, Andrew
Sent: Tuesday, October 30, 2018 6:49 PM
To: Rainer, Michelle <Michelle.Rainer@dfo-mpo.gc.ca>; Girouard, Louise <Louise.Girouard@dfo-mpo.gc.ca>; Webb, Allison <Allison.Webb@dfo-mpo.gc.ca>
Cc: Bate, Dan <Dan.Bate@dfo-mpo.gc.ca>; Reid, Rebecca <Rebecca.Reid@dfo-mpo.gc.ca>
Subject: RE: FOR URGENT APPROVAL: Sea Lice story

Allison

Can AMD review the report that was the subject of the article. It contains allegations that DFO has been covering up the issue and that we (and in particular Rebecca) mislead the MAACFA committee. I would like some additional media lines to address the report itself and those allegations. I think an obvious one would be to simply state that we post the sea lice data to the website, so I don't see how we can be accused of "covering up".
The report contains excerpts of ATIPs as well.

<https://livingoceans.org/sites/default/files/Lice%20report%20final%200.pdf>

Andrew J L Thomson

Regional Director | Directeur Régionale
Fisheries Management Branch | Direction de la gestion des pêches

From: Thomson, Andrew
Sent: Tuesday, October 30, 2018 1:55 PM
To: Rainer, Michelle <Michelle.Rainer@dfo-mpo.gc.ca>; Girouard, Louise <Louise.Girouard@dfo-mpo.gc.ca>; Webb, Allison <Allison.Webb@dfo-mpo.gc.ca>
Cc: Bate, Dan <Dan.Bate@dfo-mpo.gc.ca>
Subject: RE: FOR URGENT APPROVAL: Sea Lice story

Good, thanks

Andrew J L Thomson

Regional Director | Directeur Régionale
Fisheries Management Branch | Direction de la gestion des pêches

From: Rainer, Michelle
Sent: Tuesday, October 30, 2018 1:54 PM
To: Thomson, Andrew <Andrew.Thomson@dfo-mpo.gc.ca>; Girouard, Louise <Louise.Girouard@dfo-mpo.gc.ca>; Webb, Allison <Allison.Webb@dfo-mpo.gc.ca>
Cc: Bate, Dan <Dan.Bate@dfo-mpo.gc.ca>
Subject: RE: FOR URGENT APPROVAL: Sea Lice story

Thanks, Andy. We have these two previously approved lines:

- Under the *Pacific Aquaculture Regulations*, DFO requires salmon farming companies to regularly monitor and manage sea lice levels at their facilities in BC. DFO also regularly conducts assessments of sea lice abundance at these facilities. approved
- Companies in BC must submit a lice reduction plan if monitoring shows sea lice levels higher than three motile sea lice per farmed fish during the wild salmon outmigration period from March 1 to June 30 of each year. Motile lice are those at the free-moving stages of their life cycle. approved

We can also attach the infographic, which explains all.

From: Thomson, Andrew
Sent: October-30-18 1:52 PM
To: Girouard, Louise; Webb, Allison
Cc: Bate, Dan; Rainer, Michelle
Subject: RE: FOR URGENT APPROVAL: Sea Lice story

These are fine

I think we should include a line about how we regulate and manage lice in farms, something like:

DFO requires aquaculture operators to monitor lice loads on farm salmon and take action if threshold levels are exceeded. DFO fish health staff conduct site visits to audit lice reporting and assess compliance with license conditions.

Andrew J L Thomson

Regional Director | Directeur Régionale
Fisheries Management Branch | Direction de la gestion des pêches

From: Girouard, Louise
Sent: Tuesday, October 30, 2018 1:47 PM
To: Thomson, Andrew <Andrew.Thomson@dfo-mpo.gc.ca>; Webb, Allison <Allison.Webb@dfo-mpo.gc.ca>

Cc: Bate, Dan <Dan.Bate@dfo-mpo.gc.ca>; Rainer, Michelle <Michelle.Rainer@dfo-mpo.gc.ca>

Subject: FOR URGENT APPROVAL: Sea Lice story

Andy/ Allison:

As per Michelle R email, we drafted lines for your urgent approval.

L

Issue: Living Oceans Society [REDACTED] released a report on sea lice and SLICE resistance in the Clayoquot today <https://livingoceans.org/action/sea-lice-out-control>.

Media requests from:

[REDACTED] Vancouver Sun (short web report),
[REDACTED] Vancouver Sun (longer story),
[REDACTED] SeaWestNews, [REDACTED]

Deadline: Tuesday, October 30, 4:00 p.m. PST

Approved by: Zac Waddington, Simon Jones

Media lines:

- Seasonal and year-to-year variations in environmental parameters (eg. ocean salinity and temperature) and the number and species composition of wild salmon returns to an area are known to influence the abundance of sea lice on farms. **Approved**
- In Clayoquot sound over the winter/spring of 2017-2018, the typical drop in salinity that comes with rains did not occur. This higher salinity resulted in increased lice production in the region and exacerbated the lice levels on farms. **New**
- Earlier this year, Fisheries and Oceans Canada (DFO) collected sea lice from Cermaq Canada's Bawden site in the Clayoquot area and sent them to the BC Centre for Aquatic Health Sciences for analysis, which confirmed SLICE resistance. Those lice were later sent to researchers at the Atlantic Veterinary College who are undertaking work to better understand the genetic basis for SLICE resistance. **Approved**
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- DFO is keeping a close eye on the issue of SLICE resistance. Research is under way, by DFO, industry, and academia, to find alternative methods to manage sea lice, and to better predict and track SLICE resistance. For instance, DFO is currently studying, or supporting research on, the use of Pacific perch as "cleaner fish" that eat sea lice off farmed fish and warm water baths to kill sea lice. More information on these projects can be found at www.dfo-mpo.gc.ca/aquaculture/sci-res/rd-eng.htm **approved**

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- Hydrogen peroxide is widely used on Canada's east and west coast, and elsewhere in the world to remove sea lice from cultured fish. This pesticide is not absorbed by the fish and is non-toxic to humans. It also dissipates as a neutralized substance quickly in the environment, causing no discernible far-field effect. **Approved**

From: Thomson, Andrew

Sent: Tuesday, October 30, 2018 1:26 PM

To: Webb, Allison <Allison.Webb@dfo-mpo.gc.ca>

Cc: Girouard, Louise <Louise.Girouard@dfo-mpo.gc.ca>

Subject: Sea Lice story

Have you seen this?

<https://vancouver.sun.com/news/local-news/drug-resistant-sea-lice-out-of-control-on-b-c-coast-report>

Andrew J L Thomson

Regional Director | Directeur Régionale

Fisheries Management Branch | Direction de la gestion des pêches

Pacific Region | Région du Pacifique

Fisheries & Oceans Canada | Pêches et Océans Canada

Suite 200 – 401 Burrard St.

Vancouver, BC, Canada V6C 3S4

andrew.thomson@dfo-mpo.gc.ca

Telephone | Téléphone 604.666.0751

Facsimile | Télécopieur 250.666.8069

Government of Canada | Gouvernement du Canada

Delaney, Paula

From: Webb, Allison
Sent: October-30-18 10:56 PM
To: Delaney, Paula
Subject: FW: FOR URGENT APPROVAL: Sea Lice story

Do you mind printing for me?

Thanks so much,
Allison

Allison Webb, Director / Directrice
Aquaculture Management / Gestion de l'aquaculture
Fisheries Management Branch / Direction de la gestion des pêches
Fisheries and Oceans Canada / Pêches et Océans Canada
200 - 401 Burrard St / Rue Burrard, Vancouver BC / C.B. V6C 3S4 Canada
604-666-7009
Allison.webb@dfo-mpo.gc.ca

From: Thomson, Andrew
Sent: Tuesday, October 30, 2018 6:49 PM
To: Rainer, Michelle <Michelle.Rainer@dfo-mpo.gc.ca>; Girouard, Louise <Louise.Girouard@dfo-mpo.gc.ca>; Webb, Allison <Allison.Webb@dfo-mpo.gc.ca>
Cc: Bate, Dan <Dan.Bate@dfo-mpo.gc.ca>; Reid, Rebecca <Rebecca.Reid@dfo-mpo.gc.ca>
Subject: RE: FOR URGENT APPROVAL: Sea Lice story

Allison

Can AMD review the report that was the subject of the article. It contains allegations that DFO has been covering up the issue and that we (and in particular Rebecca) mislead the MAACFA committee. I would like some additional media lines to address the report itself and those allegations. I think an obvious one would be to simply state that we post the sea lice data to the website, so I don't see how we can be accused of "covering up" .
The report contains excerpts of ATIPs as well.

https://livingoceans.org/sites/default/files/Lice%20report%20final_0.pdf

Andrew J L Thomson

Regional Director | Directeur Régionale
Fisheries Management Branch | Direction de la gestion des pêches

From: Thomson, Andrew
Sent: Tuesday, October 30, 2018 1:55 PM
To: Rainer, Michelle <Michelle.Rainer@dfo-mpo.gc.ca>; Girouard, Louise <Louise.Girouard@dfo-mpo.gc.ca>; Webb, Allison <Allison.Webb@dfo-mpo.gc.ca>

Cc: Bate, Dan <Dan.Bate@dfo-mpo.gc.ca>
Subject: RE: FOR URGENT APPROVAL: Sea Lice story

Good, thanks

Andrew J L Thomson

Regional Director | Directeur Régionale
Fisheries Management Branch | Direction de la gestion des pêches

From: Rainer, Michelle
Sent: Tuesday, October 30, 2018 1:54 PM
To: Thomson, Andrew <Andrew.Thomson@dfo-mpo.gc.ca>; Girouard, Louise <Louise.Girouard@dfo-mpo.gc.ca>; Webb, Allison <Allison.Webb@dfo-mpo.gc.ca>
Cc: Bate, Dan <Dan.Bate@dfo-mpo.gc.ca>
Subject: RE: FOR URGENT APPROVAL: Sea Lice story

Thanks, Andy. We have these two previously approved lines:

- Under the *Pacific Aquaculture Regulations*, DFO requires salmon farming companies to regularly monitor and manage sea lice levels at their facilities in BC. DFO also regularly conducts assessments of sea lice abundance at these facilities. approved
- Companies in BC must submit a lice reduction plan if monitoring shows sea lice levels higher than three motile sea lice per farmed fish during the wild salmon outmigration period from March 1 to June 30 of each year. Motile lice are those at the free-moving stages of their life cycle. approved

We can also attach the infographic, which explains all.

From: Thomson, Andrew
Sent: October-30-18 1:52 PM
To: Girouard, Louise; Webb, Allison
Cc: Bate, Dan; Rainer, Michelle
Subject: RE: FOR URGENT APPROVAL: Sea Lice story

These are fine

I think we should include a line about how we regulate and manage lice in farms, something like:

DFO requires aquaculture operators to monitor lice loads on farm salmon and take action if threshold levels are exceeded. DFO fish health staff conduct site visits to audit lice reporting and assess compliance with license conditions.

Andrew J L Thomson

Regional Director | Directeur Régionale
Fisheries Management Branch | Direction de la gestion des pêches

From: Girouard, Louise
Sent: Tuesday, October 30, 2018 1:47 PM
To: Thomson, Andrew <Andrew.Thomson@dfo-mpo.gc.ca>; Webb, Allison <Allison.Webb@dfo-mpo.gc.ca>
Cc: Bate, Dan <Dan.Bate@dfo-mpo.gc.ca>; Rainer, Michelle <Michelle.Rainer@dfo-mpo.gc.ca>
Subject: FOR URGENT APPROVAL: Sea Lice story

Andy/ Allison:

As per Michelle R email, we drafted lines for your urgent approval.

L

Issue: Living Oceans Society [REDACTED] released a report on sea lice and SLICE resistance in the Clayoquot today <https://livingoceans.org/action/sea-lice-out-control> .

Media requests from:

[REDACTED] Vancouver Sun (short web report), [REDACTED]
[REDACTED] Vancouver Sun (longer story), [REDACTED]
[REDACTED] SeaWestNews, [REDACTED]

Deadline: Tuesday, October 30, 4:00 p.m. PST

Approved by: Zac Waddington, Simon Jones

Media lines:

- Seasonal and year-to-year variations in environmental parameters (eg.ocean salinity and temperature) and the number and species composition of wild salmon returns to an area are known to influence the abundance of sea lice on farms. **Approved**
- In Clayoquot sound over the winter/spring of 2017-2018, the typical drop in salinity that comes with rains did not occur. This higher salinity resulted in increased lice production in the region and exacerbated the lice levels on farms. **New**
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From: Thomson, Andrew

Sent: Tuesday, October 30, 2018 1:26 PM

To: Webb, Allison <Allison.Webb@dfo-mpo.gc.ca>

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Subject: Sea Lice story

Have you seen this?

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Andrew J L Thomson

Regional Director | Directeur Régionale
Fisheries Management Branch | Direction de la gestion des pêches
Pacific Region | Région du Pacifique
Fisheries & Oceans Canada | Pêches et Océans Canada

Suite 200 – 401 Burrard St.
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andrew.thomson@dfo-mpo.gc.ca
Telephone | Téléphone 604.666.0751
Facsimile | Télécopieur 250.666.8069
Government of Canada | Gouvernement du Canada

Rainer, Michelle

From: Rainer, Michelle
Sent: October-30-18 11:23 AM
To: [REDACTED]
Subject: RE: Vancouver Sun query

OK, thanks. Simon Jones should be able to speak to you about the research you cited below and of course is also an expert on sea lice in general; for the aquaculture management questions I will provide a response by email. I will check on Simon's availability.

Regards,
Michelle

From: [REDACTED]
Sent: October-30-18 10:57 AM
To: Rainer, Michelle
Subject: Re: Vancouver Sun query

Michelle,

[REDACTED] has written a web story in response to the report and just needs an immediate comment from you. I am working on a story about new technologies that Cermaq is pursuing to prevent and control sea lice, along with a look back at what they learned from last spring's outbreaks. Mine is not for overnight publication.

[REDACTED]
24 hrs Vancouver | Vancouver Sun | The Province

C: [REDACTED]
#400 – 2985 Virtual Way
Vancouver, BC V5M 4X7

* PLEASE NOTE NEW ADDRESS *



The Province

POSTMEDIA

s.19(1)

other use, dissemination, distribution, disclosure or copying is prohibited. If you have received this email in error please so advise by

reply email. Thank you.

From: "Rainer, Michelle" <Michelle.Rainer@dfo-mpo.gc.ca>

Date: Tuesday, October 30, 2018 at 10:42 AM

To: [REDACTED]

Subject: RE: Vancouver Sun query

Hi [REDACTED]

I can work on this for you. FYI, your colleague [REDACTED] also has a request on this in this morning.

Regards,

Michelle Rainer

Communications Advisor | Conseillère en communications

Fisheries and Oceans Canada | Pêches et Océans Canada

200 - 401 Burrard Street, Vancouver, B.C. V6C 3S4 | 200 - 401 rue Burrard, Vancouver, C.-B. V6C 3S4

Telephone | Téléphone 604-775-5065

From: [REDACTED]

Sent: October-30-18 10:41 AM

To: Rainer, Michelle

Subject: Vancouver Sun query

Hi Michelle

This latest Living Oceans report makes allegations that the DFO is aware that sea lice that have infested ocean-based salmon farms run by Cermaq are resistant to drug treatment.

What is the DFO's current opinion on the prevalence of sea lice near farms and more generally in B.C. Waters?

Are there indications that current treatments have failed at Cermaq farms last spring? Do we know why they failed?

Is there a way to know if lice recovered from wild salmon are resistant to drug treatments used by salmon farms?

In particular:

"Also in 2014, Dr. Simon Jones of DFO obtained public funding, in collaboration with salmon farming company Marine Harvest Canada, for a project to study sublethal effects of SLICE™ on sea lice. The text of the project description includes the following statement:

s.19(1)

“However, recent treatment failures have been linked to resistance to SLICE® within sea lice populations. While in vitro data support the conclusion that sea lice in British Columbia remain sensitive to SLICE®, treatment efficacy is variable among sites” 13 .

The full report is

here: [https://livingoceans.org/sites/default/files/Lice%20report%20final 0.pdf?utm_medium=email&utm_campaign=Lousy%20Choices&utm_content=Lousy%20Choices+CID_4db8d8fd2c1e56cb9275dee390ba17eb&utm_source=Email%20marketing%20software&utm_term=Read%20the%20report%20here%20https://livingoceans.org/sites/default/files/Lice%20report%20final 0.pdf](https://livingoceans.org/sites/default/files/Lice%20report%20final%200.pdf?utm_medium=email&utm_campaign=Lousy%20Choices&utm_content=Lousy%20Choices+CID_4db8d8fd2c1e56cb9275dee390ba17eb&utm_source=Email%20marketing%20software&utm_term=Read%20the%20report%20here%20https://livingoceans.org/sites/default/files/Lice%20report%20final%200.pdf)



24 hrs Vancouver | Vancouver Sun | The Province

C:

#400 – 2985 Virtual Way
Vancouver, BC V5M 4X7

* PLEASE NOTE NEW ADDRESS *



The Province

POSTMEDIA

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other use, dissemination, distribution, disclosure or copying is prohibited. If you have received this email in error please so advise by

reply email. Thank you.

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Waddington, Zac

From: Waddington, Zac
Sent: October-30-18 12:25 PM
To: Jones, Simon
Subject: FW: Clayoquot lice management
Attachments: may 18 18 doc.pdf

From: [REDACTED]
Sent: May-18-18 9:55 AM
To: Keith, Ian
Cc: Waddington, Zac; [REDACTED]
Subject: Re: Clayoquot lice management

Hi - see attached. I will be in the office this afternoon if you have questions.

[REDACTED]

[REDACTED]

CERMAQ

Phone +1 250-286-0022
Direct +1 250-286-0022 ext [REDACTED]
Mobile [REDACTED]

s.19(1)

Cermaq Canada Ltd.
203 - 919 Island Hwy
V9W 2C2 Campbell River, BC, Canada

[Cermaq.ca](#) [Facebook](#) [Twitter](#)

From [REDACTED]
To: "Keith, Ian" <Ian.Keith@dfo-mpo.gc.ca>
Cc: "Waddington, Zac" <Zac.Waddington@dfo-mpo.gc.ca>
Date: 13/05/2018 02:47 AM
Subject: Re: Clayoquot lice management

Thanks Ian. I will make sure everyone is informed and start on a response no day. [REDACTED]

On May 11, 2018, at 4:02 PM, Keith, Ian <Ian.Keith@dfo-mpo.gc.ca> wrote:

Hi [REDACTED]

DFO veterinarians have been monitoring the management of lice in Clayoquot, and have been in discussions with fish health and veterinary staff at Cermaq regarding plans for lice management since Fall 2017. These plans changed throughout early 2018, from 1) a January 11 plan to SLICE treat one farm pending favourable bioassay, and immediate harvest in anticipation of the outmigration period for those 3 farms where SLICE treatment was contraindicated ; to 2) a April 30 plan to peroxide-treat farms where there was exceedance during the outmigration period where SLICE treatment is contraindicated, and manage by harvest at the others. Note that the DFO response January 12 to the January 11 plan stated that when using harvest as a management tool in advance of the outmigration period, that harvesting would have to be finished by the end of February.

Millar is the only farm that has been harvested-out, to date, and none of Ross, Dixon, Mussel and Saranac, where the lice management plan is harvest, have met the required outcome of reduction in "absolute sea lice inventory" (as per licence condition 6.4(a)), based on lice data currently available to us (using average month inventory x average abundance).

While we appreciate the challenges, including delays in acquiring a Pesticide Use Permit for peroxide, we require further explanation and evidence that indicate to DFO what options have been pursued and exhausted by Cermaq that justify the current state of lice burden on numerous farms in Clayoquot. Specifically:

- Area-based SLICE treatment in late September to early October at numerous sites in Clayoquot had reduced efficacy and duration of effect than what is expected. Please demonstrate how appropriate therapeutic SLICE use was ensured as per Merck's Sllice Sustainability Project.
- How were other treatment measures considered such as increased processing capacity at other facilities, use of Marine Harvest Canada's Hydrolicer, an earlier start to harvest at affected farms, and any other options considered?
- What, if any, monitoring of smolt lice burden has Cermaq conducted to monitor for effects on wild salmon smolts?

Please provide any information and/or documents to address the questions or that will assist in our assessment of compliance regarding this issue. I look forward to hearing from you by May 18, 2018. If you have any questions or required further clarification please do not hesitate to contact Zac Waddington at 250-703-0902 or Ian Keith at 250-703-0917.

Thanks for your attention concerning this issue.

Regards,
Ian

Dr. Ian Kerth DVM
Field Operations Veterinarian – Pacific Region
Fisheries and Oceans Canada | Pêches et Océans Canada
Fisheries Management
Aquaculture Management Division | Gestion de l'aquaculture
Aquaculture Environmental Operations – Fish Health
#103 – 2435 Mansfield Drive
Courtenay, British Columbia V9N 2M2
Telephone | Téléphone: 250-703-0917
Mobile | Portable: [REDACTED]
Fax | Télécopieur: 250-703-0921
Ian.Keith@dfo-mpo.gc.ca

s.16(2)(c)

s.19(1)

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**Pages 1302 to / à 1305
are duplicates of
sont des duplicatas des
pages 601 to / à 604**

Waddington, Zac

From: Paylor, Adrienne
Sent: October-30-18 1:30 PM
To: Waddington, Zac
Subject: RE: For urgent approval: Media inquiry on sea lice report

Ok thanks ☺ & cheers

From: Waddington, Zac
Sent: October-30-18 1:29 PM
To: Paylor, Adrienne
Subject: RE: For urgent approval: Media inquiry on sea lice report

Yeah that red font is mine. I think it is good to go out as is now.

Zac

From: Paylor, Adrienne
Sent: October-30-18 12:49 PM
To: Waddington, Zac
Subject: FW: For urgent approval: Media inquiry on sea lice report
Importance: High

Can you help me review.....I'm stuck on the phone right now ☹

From: Rainer, Michelle
Sent: October-30-18 12:47 PM
To: Paylor, Adrienne; Houston, Kim
Subject: For urgent approval: Media inquiry on sea lice report
Importance: High

Hi Kim and Adrienne,

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Issue: Living Oceans Society [REDACTED] released a report on sea lice and SLICE resistance in the Clayoquot today <https://livingoceans.org/action/sea-lice-out-control> .

Media requests from:

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[REDACTED] SeaWestNews, [REDACTED]

Deadline: Tuesday, October 31, 4:00 p.m. PST

Approved by: Zac Waddington, Simon Jones

Media lines:

s.19(1)

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Paylor, Adrienne

From: Paylor, Adrienne
Sent: October-30-18 1:33 PM
To: Rainer, Michelle; Houston, Kim
Subject: RE: For urgent approval: Media inquiry on sea lice report

Approved without further edits.
Thank you,

Adrienne Paylor

Regional Manager, Aquaculture Environmental Operations
Fisheries and Oceans Canada / Pêches et Océans Canada
Aquaculture Management Division / Gestion de l'aquaculture
1520 Tamarac Street, Campbell River, BC V9W 3M5
Adrienne.paylor@dfo-mpo.gc.ca

Telephone | Téléphone 250-286-5817
Facsimile | Télécopieur 250-286-5837
Government of Canada | Gouvernement du Canada

Adrienne

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Rainer, Michelle

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To: Girouard, Louise
Subject: FW: For urgent approval: Media inquiry on sea lice report
Importance: High

From: Rainer, Michelle
Sent: October-30-18 12:54 PM
To: Webb, Allison
Subject: For urgent approval: Media inquiry on sea lice report
Importance: High

Hi Allison,

For your urgent approval. I sent this to Adrienne but need to keep this moving along [REDACTED]
[REDACTED] Not sure she needs to review as she has previously approved most of these lines anyway. The new text is red.

Thanks,
Michelle

Issue: Living Oceans Society [REDACTED] released a report on sea lice and SLICE resistance in the Clayoquot today <https://livingoceans.org/action/sea-lice-out-control> :

Media requests from:

[REDACTED] Vancouver Sun (short web report), [REDACTED]
[REDACTED] Vancouver Sun (longer story), [REDACTED]
[REDACTED] SeaWestNews, [REDACTED]

s.19(1)

Deadline: Tuesday, October 30, 4:00 p.m. PST

Approved by: Zac Waddington, Simon Jones

Media lines:

- Seasonal and year-to-year variations in environmental parameters (eg.ocean salinity and temperature) and the number and species composition of wild salmon returns to an area are known to influence the abundance of sea lice on farms. **Approved**
- In Clayoquot sound over the winter/spring of 2017-2018, the typical drop in salinity that comes with rains did not occur. This higher salinity resulted in increased lice production in the region and exacerbated the lice levels on farms. **New**
- Earlier this year, Fisheries and Oceans Canada (DFO) collected sea lice from Cermaq Canada's Bawden site in the Clayoquot area and sent them to the BC Centre for Aquatic Health Sciences for analysis, which confirmed SLICE resistance. Those lice were later sent to researchers at the Atlantic Veterinary College who are undertaking work to better understand the genetic basis for SLICE resistance. **Approved**

- The Department also initiated a review, which is still ongoing, of Cermaq Canada's sea lice management practices in this region to determine if relevant licence conditions have been followed appropriately. **Approved**
- During most years, more than 90% of sites in BC are below the regulatory thresholds for sea lice during the wild salmon outmigration period (from March 1 to June 30 of each year). However, there were documented failures of SLICE treatment at Klemtu in 2013 and Esperanza Inlet in 2017 and now Clayoquot Sound in 2018. **Approved**
- DFO is keeping a close eye on the issue of SLICE resistance. Research is under way, by DFO, industry, and academia, to find alternative methods to manage sea lice, and to better predict and track SLICE resistance. For instance, DFO is currently studying, or supporting research on, the use of Pacific perch as "cleaner fish" that eat sea lice off farmed fish and warm water baths to kill sea lice. More information on these projects can be found at www.dfo-mpo.gc.ca/aquaculture/sci-res/rd-eng.htm **approved**
- DFO is also supporting the licensing and approval process for alternative sea lice treatments, which are a necessary part of an integrated pest management approach. **Approved**

About SLICE and hydrogen peroxide treatments:

- Salmon farming companies use an in-feed therapeutant called SLICE (emamectin benzoate) to reduce lice abundance. In British Columbia to date, SLICE has generally been a very effective tool in the management of sea lice at salmon farms. **Approved**
- The rotational use of hydrogen peroxide with SLICE on farms is a key component of Integrated Pest Management (IPM). IPM aims to control pests with minimal reliance on drugs/pesticides and prevent the development of resistance. **New**
- Hydrogen peroxide is widely used on Canada's east and west coast, and elsewhere in the world to remove sea lice from cultured fish. This pesticide is not absorbed by the fish and is non-toxic to humans. It also dissipates as a neutralized substance quickly in the environment, causing no discernible far-field effect. **Approved**

Jones, Simon

From: Jones, Simon
Sent: Tuesday, October 30, 2018 1:38 PM
To: Higgins, Mark
Subject: FW: Media inquiry on sea lice report

Categories: Yellow Category

From: Rainer, Michelle
Sent: Tuesday, October 30, 2018 12:48 PM
To: Waddington, Zac <Zac.Waddington@dfo-mpo.gc.ca>; Jones, Simon <Simon.Jones@dfo-mpo.gc.ca>
Subject: RE: Media inquiry on sea lice report

Thanks to both of you; this looks great.

From: Waddington, Zac
Sent: October-30-18 12:43 PM
To: Rainer, Michelle; Jones, Simon
Subject: RE: Media inquiry on sea lice report

Please see my edits below in red. Simon and I had a chat and the comments below reflect what we were thinking,

Zac

From: Rainer, Michelle
Sent: October-30-18 11:49 AM
To: Jones, Simon; Waddington, Zac
Subject: FW: Media inquiry on sea lice report

Hi Zac and Simon. Here is a clean version of the draft so far.
Thanks,
Michelle

Issue: Living Oceans Society [REDACTED] released a report on sea lice and SLICE resistance in the Clayoquot today <https://livingoceans.org/action/sea-lice-out-control> .

Media requests from:

[REDACTED] Vancouver Sun (short web report),
[REDACTED] Vancouver Sun (longer story),
[REDACTED] SeaWestNews, [REDACTED]

Deadline: Tuesday, October 31, 4:00 p.m. PST

s.19(1)

Media lines:

- Seasonal and year-to-year variations in environmental parameters (eg. ocean salinity and temperature) and the number and species composition of wild salmon returns to an area are known to influence the abundance of sea lice on farms. **Approved**
- In Clayoquot sound over the winter/spring of 2017-2018, the typical drop in salinity that comes with rains did not occur. This higher salinity resulted in increased lice production in the region and exacerbated the lice levels on farms. **New**
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Bate, Dan

From: Rainer, Michelle
Sent: October-30-18 1:54 PM
To: Thomson, Andrew; Girouard, Louise; Webb, Allison
Cc: Bate, Dan
Subject: RE: FOR URGENT APPROVAL: Sea Lice story
Attachments: Sea lice infographic_EN.pdf

Thanks, Andy. We have these two previously approved lines:

- Under the *Pacific Aquaculture Regulations*, DFO requires salmon farming companies to regularly monitor and manage sea lice levels at their facilities in BC. DFO also regularly conducts assessments of sea lice abundance at these facilities. approved
- Companies in BC must submit a lice reduction plan if monitoring shows sea lice levels higher than three motile sea lice per farmed fish during the wild salmon outmigration period from March 1 to June 30 of each year. Motile lice are those at the free-moving stages of their life cycle. approved

We can also attach the infographic, which explains all.

From: Thomson, Andrew
Sent: October-30-18 1:52 PM
To: Girouard, Louise; Webb, Allison
Cc: Bate, Dan; Rainer, Michelle
Subject: RE: FOR URGENT APPROVAL: Sea Lice story

These are fine

I think we should include a line about how we regulate and manage lice in farms, something like:

DFO requires aquaculture operators to monitor lice loads on farm salmon and take action if threshold levels are exceeded. DFO fish health staff conduct site visits to audit lice reporting and assess compliance with license conditions.

Andrew J L Thomson

Regional Director | Directeur Régionale
Fisheries Management Branch | Direction de la gestion des pêches

From: Girouard, Louise
Sent: Tuesday, October 30, 2018 1:47 PM
To: Thomson, Andrew <Andrew.Thomson@dfo-mpo.gc.ca>; Webb, Allison <Allison.Webb@dfo-mpo.gc.ca>
Cc: Bate, Dan <Dan.Bate@dfo-mpo.gc.ca>; Rainer, Michelle <Michelle.Rainer@dfo-mpo.gc.ca>
Subject: FOR URGENT APPROVAL: Sea Lice story

Andy/ Allison:

As per Michelle R email, we drafted lines for your urgent approval.

L

Issue: Living Oceans Society [REDACTED] released a report on sea lice and SLICE resistance in the Clayoquot today <https://livingoceans.org/action/sea-lice-out-control>.

Media requests from:

[REDACTED] Vancouver Sun (short web report),
[REDACTED] Vancouver Sun (longer story),
[REDACTED] SeaWestNews, [REDACTED]

Deadline: Tuesday, October 30, 4:00 p.m. PST

Approved by: Zac Waddington, Simon Jones

Media lines:

- Seasonal and year-to-year variations in environmental parameters (eg. ocean salinity and temperature) and the number and species composition of wild salmon returns to an area are known to influence the abundance of sea lice on farms. **Approved**
- In Clayoquot sound over the winter/spring of 2017-2018, the typical drop in salinity that comes with rains did not occur. This higher salinity resulted in increased lice production in the region and exacerbated the lice levels on farms. **New**
- Earlier this year, Fisheries and Oceans Canada (DFO) collected sea lice from Cermaq Canada's Bawden site in the Clayoquot area and sent them to the BC Centre for Aquatic Health Sciences for analysis, which confirmed SLICE resistance. Those lice were later sent to researchers at the Atlantic Veterinary College who are undertaking work to better understand the genetic basis for SLICE resistance. **Approved**
- The Department also initiated a review, which is still ongoing, of Cermaq Canada's sea lice management practices in this region to determine if relevant licence conditions have been followed appropriately. **Approved**
- During most years, more than 90% of sites in BC are below the regulatory thresholds for sea lice during the wild salmon outmigration period (from March 1 to June 30 of each year). However, there were documented failures of SLICE treatment at Klemtu in 2013 and Esperanza Inlet in 2017 and now Clayoquot Sound in 2018. **Approved**
- DFO is keeping a close eye on the issue of SLICE resistance. Research is under way, by DFO, industry, and academia, to find alternative methods to manage sea lice, and to better predict and track SLICE resistance. For instance, DFO is currently studying, or supporting research on, the use of Pacific perch as "cleaner fish" that eat sea lice off farmed fish and warm water baths to kill sea lice. More information on these projects can be found at www.dfo-mpo.gc.ca/aquaculture/sci-res/rd-eng.htm **approved**
- DFO is also supporting the licensing and approval process for alternative sea lice treatments, which are a necessary part of an integrated pest management approach. **Approved**

About SLICE and hydrogen peroxide treatments:

s.19(1)

- Salmon farming companies use an in-feed therapeutant called SLICE (emamectin benzoate) to reduce lice abundance. In British Columbia to date, SLICE has generally been a very effective tool in the management of sea lice at salmon farms. **Approved**
- The rotational use of hydrogen peroxide with SLICE on farms is a key component of Integrated Pest Management (IPM). IPM aims to control pests with minimal reliance on drugs/pesticides and prevent the development of resistance. **New**
- Hydrogen peroxide is widely used on Canada's east and west coast, and elsewhere in the world to remove sea lice from cultured fish. This pesticide is not absorbed by the fish and is non-toxic to humans. It also dissipates as a neutralized substance quickly in the environment, causing no discernible far-field effect. **Approved**

From: Thomson, Andrew

Sent: Tuesday, October 30, 2018 1:26 PM

To: Webb, Allison <Allison.Webb@dfo-mpo.gc.ca>

Cc: Girouard, Louise <Louise.Girouard@dfo-mpo.gc.ca>

Subject: Sea Lice story

Have you seen this?

<https://vancouversun.com/news/local-news/drug-resistant-sea-lice-out-of-control-on-b-c-coast-report>

Andrew J L Thomson

Regional Director | Directeur Régionale
Fisheries Management Branch | Direction de la gestion des pêches
Pacific Region | Region du Pacifique
Fisheries & Oceans Canada | Pêches et Océans Canada

Suite 200 – 401 Burrard St.
Vancouver, BC, Canada V6C 3S4
andrew.thomson@dfo-mpo.gc.ca
Telephone | Téléphone 604.666.0751
Facsimile | Télécopieur 250.666.8069
Government of Canada | Gouvernement du Canada

Sea lice management at BC salmon farms

Sea lice are parasites that have lived in BC's coastal waters for thousands of years. Farmed fish are free of sea lice when they enter the ocean but can pick them up in the marine environment.

The species of sea lice that most affects wild and farmed salmon is called *L. salmonis*.

Sea lice generally do not harm adult fish but can harm small juvenile salmon.

Fisheries and Oceans Canada's (DFO's) requirements ensure that lice numbers are lowest during the outmigration period, when wild juvenile salmon are at greatest risk.

WHAT ARE SEA LICE?

YEAR ROUND

Farm operators must routinely conduct counts of sea lice on their fish and report these numbers monthly to DFO.

MARCH 1 TO JUNE 30

WILD JUVENILE OUTMIGRATION PERIOD

This is when young, wild salmon journey from their freshwater birthplaces to the ocean.

If counts of farmed fish show an average of more than 3 motile *L. salmonis* per fish, farm operators must take measures to reduce lice levels. "Motiles" are lice at the free-moving stage of their life cycle.

All active farms are monitored for sea lice and DFO audits 50% of farms during the outmigration period.

Most years, more than 90% of sites are below the regulatory thresholds for sea lice during this critical time.

OUTMIGRATION BEGINS

OUTMIGRATION ENDS

JULY TO DECEMBER

In late summer, wild salmon start to return to their spawning grounds. These wild fish naturally carry sea lice, which they can transfer to farmed salmon. This is why lice levels on farms begin to increase in late summer and peak in early winter.

On the farms, sea lice can proliferate due to the high population density of fish.

Farms must increase monitoring and implement a sea lice management plan if levels exceed 3 sea lice motiles per fish; however, treatment is not required at this time (this minimizes the release of chemicals into the environment).

SEA LICE TREATMENTS APPLIED

UNMANAGED LICE LEVELS

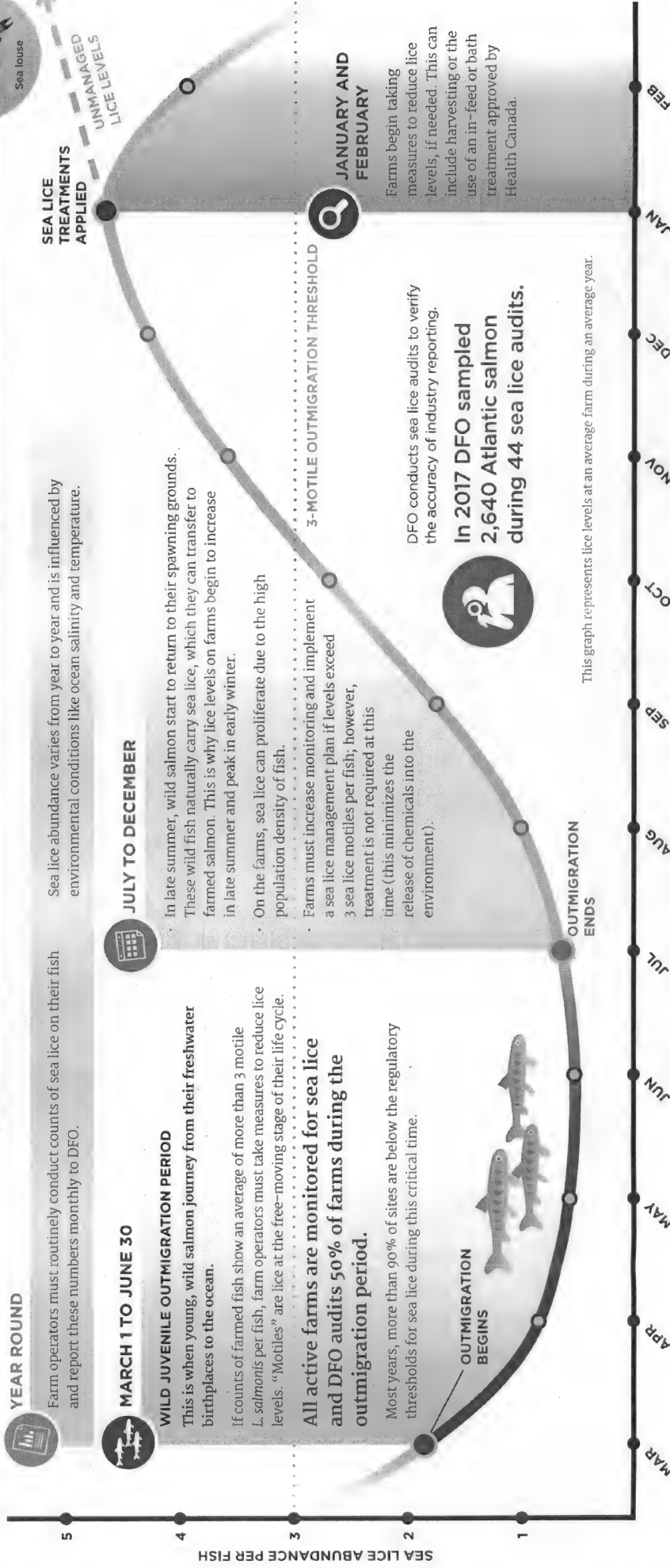
JANUARY AND FEBRUARY

Farms begin taking measures to reduce lice levels, if needed. This can include harvesting or the use of an in-feed or bath treatment approved by Health Canada.

DFO conducts sea lice audits to verify the accuracy of industry reporting.

In 2017 DFO sampled 2,640 Atlantic salmon during 44 sea lice audits.

This graph represents lice levels at an average farm during an average year.



Bate, Dan

From: Rainer, Michelle
Sent: October-30-18 2:01 PM
To: Webb, Allison; Thomson, Andrew; Girouard, Louise
Cc: Bate, Dan
Subject: RE: FOR URGENT APPROVAL: Sea Lice story

Thanks, Allison. The 4 p.m. deadline is the time we need to get the response to the reporter so we should really say "reporter's deadline".

From: Webb, Allison
Sent: October-30-18 1:56 PM
To: Thomson, Andrew; Girouard, Louise
Cc: Bate, Dan; Rainer, Michelle
Subject: RE: FOR URGENT APPROVAL: Sea Lice story

I support Andy's point below. Otherwise good to go.

Why is this so time sensitive? I was informed that this needed to be approved by 4pm and was working on it now? Tx.

Allison Webb, Director / Directrice
Aquaculture Management / Gestion de l'aquaculture
Fisheries Management Branch / Direction de la gestion des pêches
Fisheries and Oceans Canada / Pêches et Océans Canada
200 - 401 Burrard St / Rue Burrard, Vancouver BC / C.B. V6C 3S4 Canada
604-666-7009
Allison.webb@dfo-mpo.gc.ca

From: Thomson, Andrew
Sent: Tuesday, October 30, 2018 1:52 PM
To: Girouard, Louise <Louise.Girouard@dfo-mpo.gc.ca>; Webb, Allison <Allison.Webb@dfo-mpo.gc.ca>
Cc: Bate, Dan <Dan.Bate@dfo-mpo.gc.ca>; Rainer, Michelle <Michelle.Rainer@dfo-mpo.gc.ca>
Subject: RE: FOR URGENT APPROVAL: Sea Lice story

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Andrew J L Thomson

Regional Director | Directeur Régionale
Fisheries Management Branch | Direction de la gestion des pêches

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Cc: Bate, Dan <Dan.Bate@dfo-mpo.gc.ca>; Rainer, Michelle <Michelle.Rainer@dfo-mpo.gc.ca>
Subject: FOR URGENT APPROVAL: Sea Lice story

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[REDACTED] SeaWestNews, [REDACTED]

Deadline: Tuesday, October 30, 4:00 p.m. PST

Approved by: Zac Waddington, Simon Jones

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From: Thomson, Andrew

Sent: Tuesday, October 30, 2018 1:26 PM

To: Webb, Allison <Allison.Webb@dfo-mpo.gc.ca>

Cc: Girouard, Louise <Louise.Girouard@dfo-mpo.gc.ca>

Subject: Sea Lice story

Have you seen this?

<https://vancouversun.com/news/local-news/drug-resistant-sea-lice-out-of-control-on-b-c-coast-report>

Andrew J L Thomson

Regional Director | Directeur Régionale
Fisheries Management Branch | Direction de la gestion des pêches
Pacific Region | Région du Pacifique
Fisheries & Oceans Canada | Pêches et Océans Canada

Suite 200 – 401 Burrard St.
Vancouver, BC, Canada V6C 3S4
andrew.thomson@dfo-mpo.gc.ca
Telephone | Téléphone 604.666.0751
Facsimile | Télécopieur 250.666.8069
Government of Canada | Gouvernement du Canada

Bate, Dan

From: Saindon, Carole
Sent: October-30-18 2:20 PM
To: Bate, Dan; Stanek, Frank; Chow, Vance; Mayrand, Benoit; NCR Media RCN (DFO/MPO)
Cc: Hubley, Marian; McElhone, Kathryn; Quinn, Caroline; Smith, Kathleen; Fagan, Ashley; Girouard, Louise; Rainer, Michelle; Seguin, Natalie
Subject: RE: FOR APPROVAL: Various outlets, Living Oceans Society report, Sea Lice
Importance: High

Thanks Dan. Ashley Fagan and Natalie will each run by their client group.

Once that is complete, Benoit (who is on call this evening) will run by DMO/MinO.

Stay tuned.

From: Bate, Dan
Sent: October-30-18 5:04 PM
To: Stanek, Frank; Saindon, Carole; Chow, Vance; Mayrand, Benoit; NCR Media RCN (DFO/MPO)
Cc: Hubley, Marian; McElhone, Kathryn; Quinn, Caroline; Smith, Kathleen; Fagan, Ashley; Girouard, Louise; Rainer, Michelle
Subject: FOR APPROVAL: Various outlets, Living Oceans Society report, Sea Lice

Hi Carole,
Multiple enquires on a recent report on SLICE resistant from Living Oceans [REDACTED]

Thanks,
Dan

Issue: Living Oceans Society [REDACTED] released a report on sea lice and SLICE resistance in the Clayoquot today <https://livingoceans.org/action/sea-lice-out-control> Recent coverage here: <https://vancouver.sun.com/news/local-news/drug-resistant-sea-lice-out-of-control-on-b-c-coast-report>

Media requests from:

[REDACTED] Vancouver Sun (short web report).
[REDACTED] Vancouver Sun (longer story),
[REDACTED] SeaWestNews, [REDACTED]

Deadline: Tuesday, October 30, 4:00 p.m. PST

Approved by: Zac Waddington, Simon Jones, Allison Webb, Louise Girouard, Andy Thompson (A/RDG)

Media lines:

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Dan Bate

Team Lead, Communications
Fisheries and Oceans Canada Pacific Region / Canadian Coast Guard / Government of Canada
Dan.Bate@dfo-mpo.gc.ca / Tel: (604) 775-8809 / Cell: [REDACTED]

Chef d'équipe, communications
Pêches et Océans Canada, région du Pacifique / Garde côtière canadienne / Gouvernement du Canada
Dan.Bate@dfo-mpo.gc.ca / Tél : (604) 775-8809 / Tél. cell. : [REDACTED]

s.16(2)(c)

Bate, Dan

From: Mayrand, Benoit
Sent: October-30-18 3:09 PM
To: Lubczuk, Jocelyn
Cc: Des Rosiers, Marie-Pascale; Mitchell, Laura; Young, George; O'Grady, Samantha; Tran, Thi; Choeurng, Stephanie; Windsor, Victoria; Knudsen, Mark; Kahn, Zoe; Jarjour, Jasmine; Hirani, Samia; Khwaja, Saba; Butcher, Ashley; Turple, Justin; Belle-Isle, Alain; McDonald, Lindsey; Hubley, Marian; McElhone, Kathryn; Quirion, Stephanie; Quinn, Caroline; Wiebe, Robert; Jackson, Ashley; Smith, Kathleen; Seguin, Natalie; Szerze, Anita; Bate, Dan; Girouard, Louise; Rainer, Michelle; Lachapelle, Edith; Stanek, Frank; Saindon, Carole; Chow, Vance; Eatmon, Keegan; NCR Media RCN (DFO/MPO); ComApproval / Approbation (DFO/MPO)
Subject: RE: HEADS UP: Media inquiries: Various outlets, Living Oceans Society report, Sea Lice

Noted - Many thanks!
Benoit

From: Lubczuk, Jocelyn
Sent: October-30-18 6:07 PM
To: Mayrand, Benoit
Cc: Des Rosiers, Marie-Pascale; Mitchell, Laura; Young, George; O'Grady, Samantha; Tran, Thi; Choeurng, Stephanie; Windsor, Victoria; Knudsen, Mark; Kahn, Zoe; Jarjour, Jasmine; Hirani, Samia; Khwaja, Saba; Butcher, Ashley; Turple, Justin; Belle-Isle, Alain; McDonald, Lindsey; Hubley, Marian; McElhone, Kathryn; Quirion, Stephanie; Quinn, Caroline; Wiebe, Robert; Jackson, Ashley; Smith, Kathleen; Seguin, Natalie; Szerze, Anita; Bate, Dan; Girouard, Louise; Rainer, Michelle; Lachapelle, Edith; Stanek, Frank; Saindon, Carole; Chow, Vance; Eatmon, Keegan; NCR Media RCN (DFO/MPO); ComApproval / Approbation (DFO/MPO)
Subject: RE: HEADS UP: Media inquiries: Various outlets, Living Oceans Society report, Sea Lice

Thanks, approved.
Joc

Jocelyn Lubczuk
Press Secretary
Fisheries, Oceans and the Canadian Coast Guard
Jocelyn.lubczuk@dfo-mpo.gc.ca

From: Mayrand, Benoit
Sent: Tuesday, October 30, 2018 6:06 PM
To: Lubczuk, Jocelyn <Jocelyn.Lubczuk@dfo-mpo.gc.ca>
Cc: Des Rosiers, Marie-Pascale <Marie-Pascale.DesRosiers@dfo-mpo.gc.ca>; Mitchell, Laura <Laura.Mitchell@dfo-mpo.gc.ca>; Young, George <George.Young@dfo-mpo.gc.ca>; O'Grady, Samantha <Samantha.O'grady@dfo-mpo.gc.ca>; Tran, Thi <Thi.Tran@dfo-mpo.gc.ca>; Choeurng, Stephanie <Stephanie.Choeurng@dfo-mpo.gc.ca>; Windsor, Victoria <Victoria.Windsor@dfo-mpo.gc.ca>; Knudsen, Mark <Mark.Knudsen@dfo-mpo.gc.ca>; Kahn, Zoe <Zoe.Kahn@dfo-mpo.gc.ca>; Jarjour, Jasmine <Jasmine.Jarjour@dfo-mpo.gc.ca>; Hirani, Samia <Samia.Hirani@dfo-mpo.gc.ca>; Khwaja, Saba <Saba.Khwaja@dfo-mpo.gc.ca>; Butcher, Ashley <Ashley.Butcher@dfo-mpo.gc.ca>; Turple, Justin <Justin.Turple@dfo-mpo.gc.ca>; Belle-Isle, Alain <Alain.Belle-Isle@dfo-mpo.gc.ca>; McDonald, Lindsey <Lindsey.McDonald@dfo-mpo.gc.ca>; Hubley, Marian <Marian.Hubley@dfo-mpo.gc.ca>; McElhone, Kathryn <Kathryn.Mcelhone@dfo-mpo.gc.ca>; Quirion, Stephanie <Stephanie.Quirion@dfo-mpo.gc.ca>; Quinn, Caroline

<Caroline.Quinn@dfo-mpo.gc.ca>; Wiebe, Robert <Robert.Wiebe@dfo-mpo.gc.ca>; Jackson, Ashley <Ashley.Jackson@dfo-mpo.gc.ca>; Smith, Kathleen <Kathleen.Smith@dfo-mpo.gc.ca>; Seguin, Natalie <Natalie.Seguin@dfo-mpo.gc.ca>; Szerze, Anita <Anita.Szerze@dfo-mpo.gc.ca>; Bate, Dan <Dan.Bate@dfo-mpo.gc.ca>; Girouard, Louise <Louise.Girouard@dfo-mpo.gc.ca>; Rainer, Michelle <Michelle.Rainer@dfo-mpo.gc.ca>; Lachapelle, Edith <Edith.Lachapelle@dfo-mpo.gc.ca>; Stanek, Frank <Frank.Stanek@dfo-mpo.gc.ca>; Saindon, Carole <Carole.Saindon@dfo-mpo.gc.ca>; Chow, Vance <Vance.Chow@dfo-mpo.gc.ca>; Eatmon, Keegan <Keegan.Eatmon@dfo-mpo.gc.ca>; NCR Media RCN (DFO/MPO) <Media.XNCR@dfo-mpo.gc.ca>; ComApproval / Approbation (DFO/MPO) <ComApproval/Approbation.XNCR@dfo-mpo.gc.ca>
Subject: RE: HEADS UP: Media inquiries: Various outlets, Living Oceans Society report, Sea Lice
Importance: High

Hi Jocelyn,

Lines were approved by ADM Arran McPherson.

For you approval by 7:00pm if possible.

Thank you!

Benoit

From: Lubczuk, Jocelyn

Sent: October-30-18 5:55 PM

To: Mayrand, Benoit

Cc: Des Rosiers, Marie-Pascale; Mitchell, Laura; Young, George; O'Grady, Samantha; Tran, Thi; Choeurng, Stephanie; Windsor, Victoria; Knudsen, Mark; Kahn, Zoe; Jarjour, Jasmine; Hirani, Samia; Khwaja, Saba; Butcher, Ashley; Turple, Justin; Belle-Isle, Alain; McDonald, Lindsey; Hubley, Marian; McElhone, Kathryn; Quirion, Stephanie; Quinn, Caroline; Wiebe, Robert; Jackson, Ashley; Smith, Kathleen; Seguin, Natalie; Szerze, Anita; Bate, Dan; Girouard, Louise; Rainer, Michelle; Lachapelle, Edith; Stanek, Frank; Saindon, Carole; Chow, Vance; Eatmon, Keegan; NCR Media RCN (DFO/MPO); ComApproval / Approbation (DFO/MPO)

Subject: RE: HEADS UP: Media inquiries: Various outlets, Living Oceans Society report, Sea Lice

Thank you!!

Jocelyn Lubczuk

Press Secretary

Fisheries, Oceans and the Canadian Coast Guard

Jocelyn.lubczuk@dfo-mpo.gc.ca

From: Mayrand, Benoit

Sent: Tuesday, October 30, 2018 5:54 PM

To: Lubczuk, Jocelyn <Jocelyn.Lubczuk@dfo-mpo.gc.ca>

Cc: Des Rosiers, Marie-Pascale <Marie-Pascale.DesRosiers@dfo-mpo.gc.ca>; Mitchell, Laura <Laura.Mitchell@dfo-mpo.gc.ca>; Young, George <George.Young@dfo-mpo.gc.ca>; O'Grady, Samantha <Samantha.O'grady@dfo-mpo.gc.ca>; Tran, Thi <Thi.Tran@dfo-mpo.gc.ca>; Choeurng, Stephanie <Stephanie.Choeurng@dfo-mpo.gc.ca>; Windsor, Victoria <Victoria.Windsor@dfo-mpo.gc.ca>; Knudsen, Mark <Mark.Knudsen@dfo-mpo.gc.ca>; Kahn, Zoe <Zoe.Kahn@dfo-mpo.gc.ca>; Jarjour, Jasmine <Jasmine.Jarjour@dfo-mpo.gc.ca>; Hirani, Samia <Samia.Hirani@dfo-mpo.gc.ca>; Khwaja, Saba <Saba.Khwaja@dfo-mpo.gc.ca>; Butcher, Ashley <Ashley.Butcher@dfo-mpo.gc.ca>; Turple, Justin <Justin.Turple@dfo-mpo.gc.ca>; Belle-Isle, Alain <Alain.Belle-Isle@dfo-mpo.gc.ca>; McDonald, Lindsey <Lindsey.McDonald@dfo-mpo.gc.ca>; Hubley, Marian <Marian.Hubley@dfo-mpo.gc.ca>; McElhone, Kathryn <Kathryn.Mcelhone@dfo-mpo.gc.ca>; Quirion, Stephanie <Stephanie.Quirion@dfo-mpo.gc.ca>; Quinn, Caroline <Caroline.Quinn@dfo-mpo.gc.ca>; Wiebe, Robert <Robert.Wiebe@dfo-mpo.gc.ca>; Jackson, Ashley

<Ashley.Jackson@dfo-mpo.gc.ca>; Smith, Kathleen <Kathleen.Smith@dfo-mpo.gc.ca>; Seguin, Natalie <Natalie.Seguin@dfo-mpo.gc.ca>; Szerze, Anita <Anita.Szerze@dfo-mpo.gc.ca>; Bate, Dan <Dan.Bate@dfo-mpo.gc.ca>; Girouard, Louise <Louise.Girouard@dfo-mpo.gc.ca>; Rainer, Michelle <Michelle.Rainer@dfo-mpo.gc.ca>; Lachapelle, Edith <Edith.Lachapelle@dfo-mpo.gc.ca>; Stanek, Frank <Frank.Stanek@dfo-mpo.gc.ca>; Saindon, Carole <Carole.Saindon@dfo-mpo.gc.ca>; Chow, Vance <Vance.Chow@dfo-mpo.gc.ca>; Eatmon, Keegan <Keegan.Eatmon@dfo-mpo.gc.ca>; NCR Media RCN (DFO/MPO) <Media.XNCR@dfo-mpo.gc.ca>; ComApproval / Approbation (DFO/MPO) <ComApproval/Approbation.XNCR@dfo-mpo.gc.ca>

Subject: HEADS UP: Media inquiries: Various outlets, Living Oceans Society report, Sea Lice

Importance: High

Hi Jocelyn,

We received multiple media inquiries on a recent report on sea lice resistance from Living Oceans

We are currently running the lines below for approval in NHQ.

We will keep you apprised.

Benoit Mayrand

Communications Advisor | Conseiller en communications
Media Relations | Relations avec les médias
Fisheries, Oceans and the Canadian Coast Guard | Government of Canada
Pêches, Océans et la Garde côtière canadienne | Gouvernement du Canada
Tel : 613-993-9720
Benoit.Mayrand@dfo-mpo.gc.ca

Issue: Living Oceans Society released a report on sea lice and SLICE resistance in the Clayoquot today <https://livingoceans.org/action/sea-lice-out-control> Recent coverage here: <https://vancouversun.com/news/local-news/drug-resistant-sea-lice-out-of-control-on-b-c-coast-report>

Media requests from:

Vancouver Sun (short web report),
Vancouver Sun (longer story),
SeaWestNews,

Deadline: Tuesday, October 30, 4:00 p.m. PST

Approved by: Zac Waddington, Simon Jones, Allison Webb, Louise Girouard, Andy Thompson (A/RDG)

Media lines:

- Seasonal and year-to-year variations in environmental parameters (eg.ocean salinity and temperature) and the number and species composition of wild salmon returns to an area are known to influence the abundance of sea lice on farms. **Approved**
- In Clayoquot sound over the winter/spring of 2017-2018, the typical drop in salinity that comes with rains did not occur. This higher salinity resulted in increased lice production in the region and exacerbated the lice levels on farms. **New**
- Earlier this year, Fisheries and Oceans Canada (DFO) collected sea lice from Cermaq Canada's Bawden site in the Clayoquot area and sent them to the BC Centre for Aquatic Health Sciences for analysis, which confirmed SLICE resistance. Those lice were later sent to researchers at the Atlantic Veterinary College who are undertaking work to better understand the genetic basis for SLICE resistance. **Approved**

- The Department also initiated a review, which is still ongoing, of Cermaq Canada's sea lice management practices in this region to determine if relevant licence conditions have been followed appropriately. **Approved**
- Under the Pacific Aquaculture Regulations, DFO requires salmon farming companies to regularly monitor and manage sea lice levels at their facilities in BC. DFO also regularly conducts assessments of sea lice abundance at these facilities. **Approved**
- Companies in BC must submit a lice reduction plan if monitoring shows sea lice levels higher than three motile sea lice per farmed fish during the wild salmon outmigration period from March 1 to June 30 of each year. Motile lice are those at the free-moving stages of their life cycle. **Approved**
- During most years, more than 90% of sites in BC are below the regulatory thresholds for sea lice during the wild salmon outmigration period (from March 1 to June 30 of each year). However, there were documented failures of SLICE treatment at Klemtu in 2013 and Esperanza Inlet in 2017 and now Clayoquot Sound in 2018. **Approved**
- DFO is keeping a close eye on the issue of SLICE resistance. Research is under way, by DFO, industry, and academia, to find alternative methods to manage sea lice, and to better predict and track SLICE resistance. For instance, DFO is currently studying, or supporting research on, the use of Pacific perch as "cleaner fish" that eat sea lice off farmed fish and warm water baths to kill sea lice. More information on these projects can be found at www.dfo-mpo.gc.ca/aquaculture/sci-res/rd-eng.htm **Approved**
- DFO is also supporting the licensing and approval process for alternative sea lice treatments, which are a necessary part of an integrated pest management approach. **Approved**

About SLICE and hydrogen peroxide treatments:

- Salmon farming companies use an in-feed therapeutant called SLICE (emamectin benzoate) to reduce lice abundance. In British Columbia to date, SLICE has generally been a very effective tool in the management of sea lice at salmon farms. **Approved**
- The rotational use of hydrogen peroxide with SLICE on farms is a key component of Integrated Pest Management (IPM). IPM aims to control pests with minimal reliance on drugs/pesticides and prevent the development of resistance. **New**
- Hydrogen peroxide is widely used on Canada's east and west coast, and elsewhere in the world to remove sea lice from cultured fish. This pesticide is not absorbed by the fish and is non-toxic to humans. It also dissipates as a neutralized substance quickly in the environment, causing no discernible far-field effect. **Approved**

Bate, Dan

From: Bate, Dan
Sent: October-30-18 3:39 PM
To: [REDACTED]
Cc: DFO.F PAC RHQ Media / Médias QGR PAC F.MPO
Subject: RE: sea lice report

Hi [REDACTED] - don't have a spokesperson for you today, but sending along our key messaging on this issue.

Thanks,
Dan

- Seasonal and year-to-year variations in environmental parameters (eg.ocean salinity and temperature) and the number and species composition of wild salmon returns to an area are known to influence the abundance of sea lice on farms.
- In Clayoquot sound over the winter/spring of 2017-2018, the typical drop in salinity that comes with rains did not occur. This higher salinity resulted in increased lice production in the region and exacerbated the lice levels on farms.
- Earlier this year, Fisheries and Oceans Canada (DFO) collected sea lice from Cermaq Canada's Bawden site in the Clayoquot area and sent them to the BC Centre for Aquatic Health Sciences for analysis, which confirmed SLICE resistance. Those lice were later sent to researchers at the Atlantic Veterinary College who are undertaking work to better understand the genetic basis for SLICE resistance.
- The Department also initiated a review, which is still ongoing, of Cermaq Canada's sea lice management practices in this region to determine if relevant licence conditions have been followed appropriately.
- Under the Pacific Aquaculture Regulations, DFO requires salmon farming companies to regularly monitor and manage sea lice levels at their facilities in BC. DFO also regularly conducts assessments of sea lice abundance at these facilities.
- Companies in BC must submit a lice reduction plan if monitoring shows sea lice levels higher than three motile sea lice per farmed fish during the wild salmon outmigration period from March 1 to June 30 of each year. Motile lice are those at the free-moving stages of their life cycle.
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- DFO is keeping a close eye on the issue of SLICE resistance. Research is under way, by DFO, industry, and academia, to find alternative methods to manage sea lice, and to better predict and track SLICE resistance. For instance, DFO is currently studying, or supporting research on, the use of Pacific perch as "cleaner fish" that eat sea lice off farmed fish and warm water baths to kill sea lice. More information on these projects can be found at www.dfo-mpo.gc.ca/aquaculture/sci-res/rd-eng.htm
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Dan Bate

Team Lead, Communications
Fisheries and Oceans Canada Pacific Region / Canadian Coast Guard / Government of Canada
Dan.Bate@dfo-mpo.gc.ca

Chef d'équipe, communications
Pêches et Océans Canada, région du Pacifique / Garde côtière canadienne / Gouvernement du Canada
Dan.Bate@dfo-mpo.gc.ca

From: [REDACTED]
Sent: October-30-18 6:19 AM
To: DFO.F PAC RHQ Media / Médias QGR PAC F.MPO
Subject: sea lice report

Good morning,

Can someone please call me ASAP this morning to address a report from Living Oceans that claims the DFO knew as early as 2014 that resistance was developing in sea lice but did not take measures to protect wild juvenile salmon.

Thanks,

[REDACTED]
Reporter, Van Live
Vancouver Sun | The Province
#400 – 2985 Virtual Way
Vancouver, BC V5M 4X7
Phone: [REDACTED] | Mobile: [REDACTED]
Twitter: [REDACTED]



The Province



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s.19(1)

Bate, Dan

From: [REDACTED]
Sent: October-30-18 3:46 PM
To: Bate, Dan
Subject: Re: sea lice report

Very thorough. Thanks Dan.



24 hrs Vancouver | Vancouver Sun | The Province

C: [REDACTED]
#400 – 2985 Virtual Way
Vancouver, BC V5M 4X7

*** PLEASE NOTE NEW ADDRESS ***



TheProvince

POSTMEDIA

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s.19(1)

From: "Bate, Dan" <Dan.Bate@dfo-mpo.gc.ca>
Date: Tuesday, October 30, 2018 at 3:41 PM
To: [REDACTED]
Cc: "Rainer, Michelle" <Michelle.Rainer@dfo-mpo.gc.ca>
Subject: RE: sea lice report

Hi [REDACTED] Heard you were looking for info on the release of a recent report on sea lice. Sending along our key messaging on this issue.

Thanks,
Dan

- Seasonal and year-to-year variations in environmental parameters (eg.ocean salinity and temperature) and the number and species composition of wild salmon returns to an area are known to influence the abundance of sea lice on farms.
- In Clayoquot sound over the winter/spring of 2017-2018, the typical drop in salinity that comes with rains did not occur. This higher salinity resulted in increased lice production in the region and exacerbated the lice levels on farms.
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- The Department also initiated a review, which is still ongoing, of Cermaq Canada's sea lice management practices in this region to determine if relevant licence conditions have been followed appropriately.
- Under the Pacific Aquaculture Regulations, DFO requires salmon farming companies to regularly monitor and manage sea lice levels at their facilities in BC. DFO also regularly conducts assessments of sea lice abundance at these facilities.
- Companies in BC must submit a lice reduction plan if monitoring shows sea lice levels higher than three motile sea lice per farmed fish during the wild salmon outmigration period from March 1 to June 30 of each year. Motile lice are those at the free-moving stages of their life cycle.
- During most years, more than 90% of sites in BC are below the regulatory thresholds for sea lice during the wild salmon outmigration period (from March 1 to June 30 of each year). However, there were documented failures of SLICE treatment at Klemtu in 2013 and Esperanza Inlet in 2017 and now Clayoquot Sound in 2018.
- DFO is keeping a close eye on the issue of SLICE resistance. Research is under way, by DFO, industry, and academia, to find alternative methods to manage sea lice, and to better predict and track SLICE resistance. For instance, DFO is currently studying, or supporting research on, the use of Pacific perch as "cleaner fish" that eat sea lice off farmed fish and warm water baths to kill sea lice. More information on these projects can be found at www.dfo-mpo.gc.ca/aquaculture/sci-res/rd-eng.htm
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- Salmon farming companies use an in-feed therapeutant called SLICE (emamectin benzoate) to reduce lice abundance. In British Columbia to date, SLICE has generally been a very effective tool in the management of sea lice at salmon farms.

- The rotational use of hydrogen peroxide with SLICE on farms is a key component of Integrated Pest Management (IPM). IPM aims to control pests with minimal reliance on drugs/pesticides and prevent the development of resistance.
- Hydrogen peroxide is widely used on Canada's east and west coast, and elsewhere in the world to remove sea lice from cultured fish. This pesticide is not absorbed by the fish and is non-toxic to humans. It also dissipates as a neutralized substance quickly in the environment, causing no discernible far-field effect.

Dan Bate

Team Lead, Communications
Fisheries and Oceans Canada Pacific Region / Canadian Coast Guard / Government of Canada
Dan.Bate@dfo-mpo.gc.ca

Chef d'équipe, communications
Pêches et Océans Canada, région du Pacifique / Garde côtière canadienne / Gouvernement du Canada
Dan.Bate@dfo-mpo.gc.ca

Rainer, Michelle

From: Jones, Simon
Sent: October-30-18 4:29 PM
To: Rainer, Michelle
Subject: FW: Interview

Hi Michelle,

Just spoke [REDACTED] about sea lice and factors affecting their abundance and survival. I spoke in general terms about treatment options and lice resistance to slice.

Simon

From: [REDACTED]
Sent: Tuesday, October 30, 2018 2:52 PM
To: Jones, Simon <Simon.Jones@dfo-mpo.gc.ca>
Subject: Re: Interview

Hi Simon,

Let me file my overnight story and I'll see if there's time

[REDACTED]
24 hrs Vancouver | Vancouver Sun | The Province

C: [REDACTED]
#400 -- 2985 Virtual Way
Vancouver, BC V5M 4X7

s.19(1)

* PLEASE NOTE NEW ADDRESS *



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reply email. Thank you.

From: "Jones, Simon" <Simon.Jones@dfo-mpo.gc.ca>

Date: Tuesday, October 30, 2018 at 2:42 PM

To: [REDACTED]

Subject: RE: Interview

Hi [REDACTED]

I'm free this afternoon if that still works for you.

Simon

Simon R.M. Jones
*Aquatic Animal Health Section
Pacific Biological Station
Fisheries and Oceans Canada
3190 Hammond Bay Road
Nanaimo, British Columbia
V9T 6N7, Canada*

Tel: 250 729 8351

Fax: 250 756 7053

E-mail: simon.jones@dfo-mpo.gc.ca

<https://profils-profiles.science.gc.ca/en/profile/simon-jones>

s.19(1)

<https://scholar.google.ca/citations?user=JlvmjCwAAAAJ&hl=en>

From: [REDACTED]

Sent: Tuesday, October 30, 2018 1:39 PM

To: Rainer, Michelle <Michelle.Rainer@dfo-mpo.gc.ca>; Jones, Simon <Simon.Jones@dfo-mpo.gc.ca>

Subject: Re: Interview

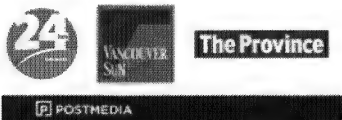
Hi Simon,

We can talk this afternoon, if you are able, but Thursday or Friday would be just as good. I need to hook up with Cermaq on this as well, which might take a day or two.

[REDACTED]
24 hrs Vancouver | Vancouver Sun | The Province

C: [REDACTED]
#400 – 2985 Virtual Way
Vancouver, BC V5M 4X7

* PLEASE NOTE NEW ADDRESS *



The information contained in this email is strictly confidential, and is only intended for the party(ies) to whom it is addressed. Any other use, dissemination, distribution, disclosure or copying is prohibited. If you have received this email in error please so advise by reply email. Thank you.

From: "Rainer, Michelle" <Michelle.Rainer@dfp-mpo.gc.ca>

Date: Tuesday, October 30, 2018 at 1:30 PM

To: "Jones, Simon" <Simon.Jones@dfp-mpo.gc.ca>, [REDACTED]

Subject: Interview

Hi [REDACTED] and Simon,

Putting you in touch with each other so you can arrange an interview about Simon's research cited in the report. Simon, [REDACTED] is not available tomorrow so would like to speak to you this afternoon. Communications will provide additional information about aquaculture regulation and sea lice management at the Cermaq sites in Clayoquot but this will likely be tomorrow.

s.19(1)

Simon's number is (250) 729-8351; [REDACTED] contact details are below.

Kind regards,
Michelle

From: [REDACTED]
Sent: October-30-18 10:41 AM
To: Rainer, Michelle
Subject: Vancouver Sun query

Hi Michelle

This latest Living Oceans report makes allegations that the DFO is aware that sea lice that have infested ocean-based salmon farms run by Cermaq are resistant to drug treatment.

What is the DFO's current opinion on the prevalence of sea lice near farms and more generally in B.C. Waters?

Are there indications that current treatments have failed at Cermaq farms last spring? Do we know why they failed?

Is there a way to know if lice recovered from wild salmon are resistant to drug treatments used by salmon farms?

In particular:

"Also in 2014, Dr. Simon Jones of DFO obtained public funding, in collaboration with salmon farming company Marine Harvest Canada, for a project to study sublethal effects of SLICE™ on sea lice. The text of the project description includes the following statement:

"However, recent treatment failures have been linked to resistance to SLICE® within sea lice populations. While in vitro data support the conclusion that sea lice in British Columbia remain sensitive to SLICE®, treatment efficacy is variable among sites" 13 .

The full report is

here: https://livingoceans.org/sites/default/files/Lice%20report%20final_0.pdf?utm_medium=email&utm_campaign=Lousy%20Choices&utm_content=Lousy%20Choices+CID_4db8d8fd2c1e56cb9275dee390ba17eb&utm_source=Email%20marketing%20software&utm_term=Read%20the%20report%20here%20httpslivingoceansorgsitesdefaultfilesLice20report20final_0pdf

s.19(1)

[REDACTED]
24 hrs Vancouver | Vancouver Sun | The Province

C: [REDACTED]
#400 – 2985 Virtual Way
Vancouver, BC V5M 4X7

s.19(1)

No further information has been removed or severed from this page

Hedderson, Lisa

Subject: FAIAP Placeholder- October 30, 2018
Location: DFO CONF Vancouver-401BurrardSt-2-2B CONF MPO, Call-in number: 1-877-413-4790 / Passcode: [REDACTED]

Start: Tue 30/10/2018 9:00 AM
End: Tue 30/10/2018 12:00 PM
Show Time As: Tentative

Recurrence: (none)

Meeting Status: Not yet responded

Organizer: Hedderson, Lisa

Required Attendees:

[REDACTED]
'lesley.fettes@gov.bc.ca'; 'Rudi.Mayser@gov.bc.ca'; Webb, Allison; Taekema, Bernie John; McCorquodale, Brenda; Lavigne, Lauren; Meadows, Shelley; Paylor, Adrienne; [REDACTED]

Good afternoon,

Please save the date for the next FAIAP meeting in Vancouver. Minutes from the July 31 meeting are attached- please send in any comments on these within the next couple of weeks and follow-up on action items as appropriate.



Draft
FAIAP_Meeting_...

October 30, 2018 – 9:00 am – 12:00 pm
Boardroom 2-D, DFO Regional Headquarters, 401 Burrard Street, Vancouver BC
Call-in number: 1-877-413-4790 / Passcode: [REDACTED]

Thank you,
Lisa

s.16(2)(c)

**Pages 1338 to / à 1342
are duplicates of
sont des duplicatas des
pages 943 to / à 947**

Bate, Dan

From: Bate, Dan
Sent: October-31-18 9:09 AM
To: Nesseth, Megan
Cc: Anderson, Laura
Subject: FW: HEADS UP: Media inquiries: Various outlets, Living Oceans Society report, Sea Lice

Hi Megan - these were approved by MINO yesterday...
The CA for Aqua in Pacific is Michelle Rainer but she's on an inspection tour this morning.

Da

From: Lubczuk, Jocelyn
Sent: October-30-18 3:07 PM
To: Mayrand, Benoit
Cc: Des Rosiers, Marie-Pascale; Mitchell, Laura; Young, George; O'Grady, Samantha; Tran, Thi; Choeurng, Stephanie; Windsor, Victoria; Knudsen, Mark; Kahn, Zoe; Jarjour, Jasmine; Hirani, Samia; Khwaja, Saba; Butcher, Ashley; Turple, Justin; Belle-Isle, Alain; McDonald, Lindsey; Hubley, Marian; McElhone, Kathryn; Quirion, Stephanie; Quinn, Caroline; Wiebe, Robert; Jackson, Ashley; Smith, Kathleen; Seguin, Natalie; Szerze, Anita; Bate, Dan; Girouard, Louise; Rainer, Michelle; Lachapelle, Edith; Stanek, Frank; Saindon, Carole; Chow, Vance; Eatmon, Keegan; NCR Media RCN (DFO/MPO); ComApproval / Approbation (DFO/MPO)
Subject: RE: HEADS UP: Media inquiries: Various outlets, Living Oceans Society report, Sea Lice

Thanks, approved.
Joc

Jocelyn Lubczuk
Press Secretary
Fisheries, Oceans and the Canadian Coast Guard
Jocelyn.lubczuk@dfo-mpo.gc.ca

From: Mayrand, Benoit
Sent: Tuesday, October 30, 2018 6:06 PM
To: Lubczuk, Jocelyn <Jocelyn.Lubczuk@dfo-mpo.gc.ca>
Cc: Des Rosiers, Marie-Pascale <Marie-Pascale.DesRosiers@dfo-mpo.gc.ca>; Mitchell, Laura <Laura.Mitchell@dfo-mpo.gc.ca>; Young, George <George.Young@dfo-mpo.gc.ca>; O'Grady, Samantha <Samantha.O'grady@dfo-mpo.gc.ca>; Tran, Thi <Thi.Tran@dfo-mpo.gc.ca>; Choeurng, Stephanie <Stephanie.Choeurng@dfo-mpo.gc.ca>; Windsor, Victoria <Victoria.Windsor@dfo-mpo.gc.ca>; Knudsen, Mark <Mark.Knudsen@dfo-mpo.gc.ca>; Kahn, Zoe <Zoe.Kahn@dfo-mpo.gc.ca>; Jarjour, Jasmine <Jasmine.Jarjour@dfo-mpo.gc.ca>; Hirani, Samia <Samia.Hirani@dfo-mpo.gc.ca>; Khwaja, Saba <Saba.Khwaja@dfo-mpo.gc.ca>; Butcher, Ashley <Ashley.Butcher@dfo-mpo.gc.ca>; Turple, Justin <Justin.Turple@dfo-mpo.gc.ca>; Belle-Isle, Alain <Alain.Belle-Isle@dfo-mpo.gc.ca>; McDonald, Lindsey <Lindsey.McDonald@dfo-mpo.gc.ca>; Hubley, Marian <Marian.Hubley@dfo-mpo.gc.ca>; McElhone, Kathryn <Kathryn.Mcelhone@dfo-mpo.gc.ca>; Quirion, Stephanie <Stephanie.Quirion@dfo-mpo.gc.ca>; Quinn, Caroline <Caroline.Quinn@dfo-mpo.gc.ca>; Wiebe, Robert <Robert.Wiebe@dfo-mpo.gc.ca>; Jackson, Ashley <Ashley.Jackson@dfo-mpo.gc.ca>; Smith, Kathleen <Kathleen.Smith@dfo-mpo.gc.ca>; Seguin, Natalie <Natalie.Seguin@dfo-mpo.gc.ca>; Szerze, Anita <Anita.Szerze@dfo-mpo.gc.ca>; Bate, Dan <Dan.Bate@dfo-mpo.gc.ca>; Girouard, Louise <Louise.Girouard@dfo-mpo.gc.ca>; Rainer, Michelle <Michelle.Rainer@dfo-mpo.gc.ca>; Lachapelle, Edith <Edith.Lachapelle@dfo-mpo.gc.ca>; Stanek, Frank <Frank.Stanek@dfo-mpo.gc.ca>; Saindon, Carole

<Carole.Saindon@dfo-mpo.gc.ca>; Chow, Vance <Vance.Chow@dfo-mpo.gc.ca>; Eatmon, Keegan <Keegan.Eatmon@dfo-mpo.gc.ca>; NCR Media RCN (DFO/MPO) <Media.XNCR@dfo-mpo.gc.ca>; ComApproval / Approbation (DFO/MPO) <ComApproval/Approbation.XNCR@dfo-mpo.gc.ca>
Subject: RE: HEADS UP: Media inquiries: Various outlets, Living Oceans Society report, Sea Lice
Importance: High

Hi Jocelyn,

Lines were approved by ADM Arran McPherson.

For you approval by 7:00pm if possible.

Thank you!

Benoit

From: Lubczuk, Jocelyn

Sent: October-30-18 5:55 PM

To: Mayrand, Benoit

Cc: Des Rosiers, Marie-Pascale; Mitchell, Laura; Young, George; O'Grady, Samantha; Tran, Thi; Choeurng, Stephanie; Windsor, Victoria; Knudsen, Mark; Kahn, Zoe; Jarjour, Jasmine; Hirani, Samia; Khwaja, Saba; Butcher, Ashley; Turple, Justin; Belle-Isle, Alain; McDonald, Lindsey; Hubley, Marian; McElhone, Kathryn; Quirion, Stephanie; Quinn, Caroline; Wiebe, Robert; Jackson, Ashley; Smith, Kathleen; Seguin, Natalie; Szerze, Anita; Bate, Dan; Girouard, Louise; Rainer, Michelle; Lachapelle, Edith; Stanek, Frank; Saindon, Carole; Chow, Vance; Eatmon, Keegan; NCR Media RCN (DFO/MPO); ComApproval / Approbation (DFO/MPO)

Subject: RE: HEADS UP: Media inquiries: Various outlets, Living Oceans Society report, Sea Lice

Thank you!!

Jocelyn Lubczuk

Press Secretary

Fisheries, Oceans and the Canadian Coast Guard

Jocelyn.lubczuk@dfo-mpo.gc.ca

From: Mayrand, Benoit

Sent: Tuesday, October 30, 2018 5:54 PM

To: Lubczuk, Jocelyn <Jocelyn.Lubczuk@dfo-mpo.gc.ca>

Cc: Des Rosiers, Marie-Pascale <Marie-Pascale.DesRosiers@dfo-mpo.gc.ca>; Mitchell, Laura <Laura.Mitchell@dfo-mpo.gc.ca>; Young, George <George.Young@dfo-mpo.gc.ca>; O'Grady, Samantha <Samantha.O'grady@dfo-mpo.gc.ca>; Tran, Thi <Thi.Tran@dfo-mpo.gc.ca>; Choeurng, Stephanie <Stephanie.Choeurng@dfo-mpo.gc.ca>; Windsor, Victoria <Victoria.Windsor@dfo-mpo.gc.ca>; Knudsen, Mark <Mark.Knudsen@dfo-mpo.gc.ca>; Kahn, Zoe <Zoe.Kahn@dfo-mpo.gc.ca>; Jarjour, Jasmine <Jasmine.Jarjour@dfo-mpo.gc.ca>; Hirani, Samia <Samia.Hirani@dfo-mpo.gc.ca>; Khwaja, Saba <Saba.Khwaja@dfo-mpo.gc.ca>; Butcher, Ashley <Ashley.Butcher@dfo-mpo.gc.ca>; Turple, Justin <Justin.Turple@dfo-mpo.gc.ca>; Belle-Isle, Alain <Alain.Belle-Isle@dfo-mpo.gc.ca>; McDonald, Lindsey <Lindsey.McDonald@dfo-mpo.gc.ca>; Hubley, Marian <Marian.Hubley@dfo-mpo.gc.ca>; McElhone, Kathryn <Kathryn.McElhone@dfo-mpo.gc.ca>; Quirion, Stephanie <Stephanie.Quirion@dfo-mpo.gc.ca>; Quinn, Caroline <Caroline.Quinn@dfo-mpo.gc.ca>; Wiebe, Robert <Robert.Wiebe@dfo-mpo.gc.ca>; Jackson, Ashley <Ashley.Jackson@dfo-mpo.gc.ca>; Smith, Kathleen <Kathleen.Smith@dfo-mpo.gc.ca>; Seguin, Natalie <Natalie.Seguina@dfo-mpo.gc.ca>; Szerze, Anita <Anita.Szerze@dfo-mpo.gc.ca>; Bate, Dan <Dan.Bate@dfo-mpo.gc.ca>; Girouard, Louise <Louise.Girouard@dfo-mpo.gc.ca>; Rainer, Michelle <Michelle.Rainer@dfo-mpo.gc.ca>; Lachapelle, Edith <Edith.Lachapelle@dfo-mpo.gc.ca>; Stanek, Frank <Frank.Stanek@dfo-mpo.gc.ca>; Saindon, Carole <Carole.Saindon@dfo-mpo.gc.ca>; Chow, Vance <Vance.Chow@dfo-mpo.gc.ca>; Eatmon, Keegan

<Keegan.Eatmon@dfo-mpo.gc.ca>; NCR Media RCN (DFO/MPO) <Media.XNCR@dfo-mpo.gc.ca>; ComApproval /
Approbation (DFO/MPO) <ComApproval/Approbation.XNCR@dfo-mpo.gc.ca>

Subject: HEADS UP: Media inquiries: Various outlets, Living Oceans Society report, Sea Lice

Importance: High

Hi Jocelyn,

We received multiple media inquiries on a recent report on sea lice resistance from Living Oceans [REDACTED]

We are currently running the lines below for approval in NHQ.

We will keep you apprised.

Benoit Mayrand

Communications Advisor | Conseiller en communications

Media Relations | Relations avec les médias

Fisheries, Oceans and the Canadian Coast Guard | Government of Canada

Pêches, Océans et la Garde côtière canadienne | Gouvernement du Canada

Tel : 613-993-9720

Benoit.Mayrand@dfo-mpo.gc.ca

Issue: Living Oceans Society [REDACTED] released a report on sea lice and SLICE resistance in the Clayoquot today <https://livingoceans.org/action/sea-lice-out-control> Recent coverage here: <https://vancouver.sun.com/news/local-news/drug-resistant-sea-lice-out-of-control-on-b-c-coast-report>

Media requests from:

[REDACTED] Vancouver Sun (short web report), [REDACTED]

[REDACTED] Vancouver Sun (longer story), [REDACTED]

[REDACTED] SeaWestNews, [REDACTED]

Deadline: Tuesday, October 30, 4:00 p.m. PST

Approved by: Zac Waddington, Simon Jones, Allison Webb, Louise Girouard, Andy Thompson (A/RDG)

Media lines:

- Seasonal and year-to-year variations in environmental parameters (eg.ocean salinity and temperature) and the number and species composition of wild salmon returns to an area are known to influence the abundance of sea lice on farms. **Approved**
- In Clayoquot sound over the winter/spring of 2017-2018, the typical drop in salinity that comes with rains did not occur. This higher salinity resulted in increased lice production in the region and exacerbated the lice levels on farms. **New**
- Earlier this year, Fisheries and Oceans Canada (DFO) collected sea lice from Cermaq Canada's Bawden site in the Clayoquot area and sent them to the BC Centre for Aquatic Health Sciences for analysis, which confirmed SLICE resistance. Those lice were later sent to researchers at the Atlantic Veterinary College who are undertaking work to better understand the genetic basis for SLICE resistance. **Approved**
- The Department also initiated a review, which is still ongoing, of Cermaq Canada's sea lice management practices in this region to determine if relevant licence conditions have been followed appropriately. **Approved**
- Under the Pacific Aquaculture Regulations, DFO requires salmon farming companies to regularly monitor and manage sea lice levels at their facilities in BC. DFO also regularly conducts assessments of sea lice abundance at these facilities. **Approved**

s.19(1)

- Companies in BC must submit a lice reduction plan if monitoring shows sea lice levels higher than three motile sea lice per farmed fish during the wild salmon outmigration period from March 1 to June 30 of each year. Motile lice are those at the free-moving stages of their life cycle. **Approved**
- During most years, more than 90% of sites in BC are below the regulatory thresholds for sea lice during the wild salmon outmigration period (from March 1 to June 30 of each year). However, there were documented failures of SLICE treatment at Klemtu in 2013 and Esperanza Inlet in 2017 and now Clayoquot Sound in 2018. **Approved**
- DFO is keeping a close eye on the issue of SLICE resistance. Research is under way, by DFO, industry, and academia, to find alternative methods to manage sea lice, and to better predict and track SLICE resistance. For instance, DFO is currently studying, or supporting research on, the use of Pacific perch as "cleaner fish" that eat sea lice off farmed fish and warm water baths to kill sea lice. More information on these projects can be found at www.dfo-mpo.gc.ca/aquaculture/sci-res/rd-eng.htm **Approved**
- DFO is also supporting the licensing and approval process for alternative sea lice treatments, which are a necessary part of an integrated pest management approach. **Approved**

About SLICE and hydrogen peroxide treatments:

- Salmon farming companies use an in-feed therapeutant called SLICE (emamectin benzoate) to reduce lice abundance. In British Columbia to date, SLICE has generally been a very effective tool in the management of sea lice at salmon farms. **Approved**
- The rotational use of hydrogen peroxide with SLICE on farms is a key component of Integrated Pest Management (IPM). IPM aims to control pests with minimal reliance on drugs/pesticides and prevent the development of resistance. **New**
- Hydrogen peroxide is widely used on Canada's east and west coast, and elsewhere in the world to remove sea lice from cultured fish. This pesticide is not absorbed by the fish and is non-toxic to humans. It also dissipates as a neutralized substance quickly in the environment, causing no discernible far-field effect. **Approved**

Paylor, Adrienne

From: Paylor, Adrienne
Sent: October-31-18 10:24 AM
To: McConnachie, Sarah
Subject: FW: FOR URGENT APPROVAL: Sea Lice story

Fyi what zac had to say about the paper

From: Waddington, Zac
Sent: October-31-18 7:04 AM
To: Webb, Allison; Paylor, Adrienne
Subject: RE: FOR URGENT APPROVAL: Sea Lice story

I did take a read through that yesterday. There's definitely some wild speculation and things which are patently incorrect. One of the key points to refute much of the fear-mongering in the article is that SLICE resistance in BC has emerged in numerous other areas in the past. If you remove the selection pressure for resistance (i.e. pause treatments for month-years), it has been demonstrated that the resistance disappears in every area where it has cropped up in the past. The whole article is structured around the premise that now that resistance has been diagnosed, it will become widespread along BC's coast and be here to stay. The fundamental difference in BC is that we have a massive wild salmon population (~1000x the farmed population), which act as a reservoir of naive lice. Numerous modelling, evolutionary and retrospective studies have found that resistance in BC should be avoidable with judicious use of SLICE (and other drugs).

Hope that helps somewhat...

Zac

From: Webb, Allison
Sent: October-30-18 11:46 PM
To: Paylor, Adrienne; Waddington, Zac
Subject: Fw: FOR URGENT APPROVAL: Sea Lice story

Hi you two - really need your help on this tomorrow. Can you please review the article asap and then we can chat? I just finished reading it now. I just remembered that Zac is out of the office for some of the day. I'll follow up with you first Adrienne. Thx, Allison

Sent from my BlackBerry 10 smartphone on the Bell network.

From: Thomson, Andrew <Andrew.Thomson@dfo-mpo.gc.ca>
Sent: Tuesday, October 30, 2018 6:48 PM
To: Rainer, Michelle; Girouard, Louise; Webb, Allison
Cc: Bate, Dan; Reid, Rebecca
Subject: RE: FOR URGENT APPROVAL: Sea Lice story

Allison

Can AMD review the report that was the subject of the article. It contains allegations that DFO has been covering up the issue and that we (and in particular Rebecca) mislead the MAACFA committee. I would like some additional media lines to address the report itself and those allegations. I think an obvious one would be to simply state that we post the sea lice data to the website, so I don't see how we can be accused of "covering up" .

The report contains excerpts of ATIPs as well.

[https://livingoceans.org/sites/default/files/Lice%20report%20final 0.pdf](https://livingoceans.org/sites/default/files/Lice%20report%20final%200.pdf)

Andrew J L Thomson
Regional Director | Directeur Régionale
Fisheries Management Branch | Direction de la gestion des pêches

From: Thomson, Andrew
Sent: Tuesday, October 30, 2018 1:55 PM
To: Rainer, Michelle <Michelle.Rainer@dfo-mpo.gc.ca>; Girouard, Louise <Louise.Girouard@dfo-mpo.gc.ca>; Webb, Allison <Allison.Webb@dfo-mpo.gc.ca>
Cc: Bate, Dan <Dan.Bate@dfo-mpo.gc.ca>
Subject: RE: FOR URGENT APPROVAL: Sea Lice story

Good, thanks

Andrew J L Thomson
Regional Director | Directeur Régionale
Fisheries Management Branch | Direction de la gestion des pêches

From: Rainer, Michelle
Sent: Tuesday, October 30, 2018 1:54 PM
To: Thomson, Andrew <Andrew.Thomson@dfo-mpo.gc.ca>; Girouard, Louise <Louise.Girouard@dfo-mpo.gc.ca>; Webb, Allison <Allison.Webb@dfo-mpo.gc.ca>
Cc: Bate, Dan <Dan.Bate@dfo-mpo.gc.ca>
Subject: RE: FOR URGENT APPROVAL: Sea Lice story

Thanks, Andy. We have these two previously approved lines:

- Under the *Pacific Aquaculture Regulations*, DFO requires salmon farming companies to regularly monitor and manage sea lice levels at their facilities in BC. DFO also regularly conducts assessments of sea lice abundance at these facilities. approved
 - Companies in BC must submit a lice reduction plan if monitoring shows sea lice levels higher than three motile sea lice per farmed fish during the wild salmon outmigration period from March 1 to June 30 of each year. Motile lice are those at the free-moving stages of their life cycle. approved
- We can also attach the infographic, which explains all.

From: Thomson, Andrew
Sent: October-30-18 1:52 PM
To: Girouard, Louise; Webb, Allison
Cc: Bate, Dan; Rainer, Michelle
Subject: RE: FOR URGENT APPROVAL: Sea Lice story

These are fine

I think we should include a line about how we regulate and manage lice in farms, something like:

DFO requires aquaculture operators to monitor lice loads on farm salmon and take action if threshold levels are exceeded. DFO fish health staff conduct site visits to audit lice reporting and assess compliance with license conditions.

Andrew J L Thomson

Regional Director | Directeur Régionale

Fisheries Management Branch | Direction de la gestion des pêches

From: Girouard, Louise

Sent: Tuesday, October 30, 2018 1:47 PM

To: Thomson, Andrew <Andrew.Thomson@dfo-mpo.gc.ca>; Webb, Allison <Allison.Webb@dfo-mpo.gc.ca>

Cc: Bate, Dan <Dan.Bate@dfo-mpo.gc.ca>; Rainer, Michelle <Michelle.Rainer@dfo-mpo.gc.ca>

Subject: FOR URGENT APPROVAL: Sea Lice story

Andy/ Allison:

As per Michelle R email, we drafted lines for your urgent approval.

L

Issue: Living Oceans Society [REDACTED] released a report on sea lice and SLICE resistance in the Clayoquot today <https://livingoceans.org/action/sea-lice-out-control> .

Media requests from:

[REDACTED] Vancouver Sun (short web report), [REDACTED]

[REDACTED] Vancouver Sun (longer story), [REDACTED]

[REDACTED] SeaWestNews, [REDACTED]

Deadline: Tuesday, October 30, 4:00 p.m. PST

Approved by: Zac Waddington, Simon Jones

Media lines:

- Seasonal and year-to-year variations in environmental parameters (eg.ocean salinity and temperature) and the number and species composition of wild salmon returns to an area are known to influence the abundance of sea lice on farms. **Approved**
- In Clayoquot sound over the winter/spring of 2017-2018, the typical drop in salinity that comes with rains did not occur. This higher salinity resulted in increased lice production in the region and exacerbated the lice levels on farms. **New**
- Earlier this year, Fisheries and Oceans Canada (DFO) collected sea lice from Cermaq Canada's Bawden site in the Clayoquot area and sent them to the BC Centre for Aquatic Health Sciences for analysis, which confirmed SLICE resistance. Those lice were later sent to researchers at the Atlantic Veterinary College who are undertaking work to better understand the genetic basis for SLICE resistance. **Approved**
- The Department also initiated a review, which is still ongoing, of Cermaq Canada's sea lice management practices in this region to determine if relevant licence conditions have been followed appropriately. **Approved**

s.19(1)

- During most years, more than 90% of sites in BC are below the regulatory thresholds for sea lice during the wild salmon outmigration period (from March 1 to June 30 of each year). However, there were documented failures of SLICE treatment at Klemtu in 2013 and Esperanza Inlet in 2017 and now Clayoquot Sound in 2018. **Approved**
- DFO is keeping a close eye on the issue of SLICE resistance. Research is under way, by DFO, industry, and academia, to find alternative methods to manage sea lice, and to better predict and track SLICE resistance. For instance, DFO is currently studying, or supporting research on, the use of Pacific perch as “cleaner fish” that eat sea lice off farmed fish and warm water baths to kill sea lice. More information on these projects can be found at www.dfo-mpo.gc.ca/aquaculture/sci-res/rd-eng.htm **approved**
- DFO is also supporting the licensing and approval process for alternative sea lice treatments, which are a necessary part of an integrated pest management approach. **Approved**

About SLICE and hydrogen peroxide treatments:

- Salmon farming companies use an in-feed therapeutant called SLICE (emamectin benzoate) to reduce lice abundance. In British Columbia to date, SLICE has generally been a very effective tool in the management of sea lice at salmon farms. **Approved**
- The rotational use of hydrogen peroxide with SLICE on farms is a key component of Integrated Pest Management (IPM). IPM aims to control pests with minimal reliance on drugs/pesticides and prevent the development of resistance. **New**
- Hydrogen peroxide is widely used on Canada’s east and west coast, and elsewhere in the world to remove sea lice from cultured fish. This pesticide is not absorbed by the fish and is non-toxic to humans. It also dissipates as a neutralized substance quickly in the environment, causing no discernible far-field effect. **Approved**

From: Thomson, Andrew

Sent: Tuesday, October 30, 2018 1:26 PM

To: Webb, Allison <Allison.Webb@dfo-mpo.gc.ca>

Cc: Girouard, Louise <Louise.Girouard@dfo-mpo.gc.ca>

Subject: Sea Lice story

Have you seen this?

<https://vancouversun.com/news/local-news/drug-resistant-sea-lice-out-of-control-on-b-c-coast-report>

Andrew J L Thomson

Regional Director | Directeur Régionale

Fisheries Management Branch | Direction de la gestion des pêches

Pacific Region | Région du Pacifique

Fisheries & Oceans Canada | Pêches et Océans Canada

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Facsimile | Télécopieur 250.666.8069

Government of Canada | Gouvernement du Canada

Delaney, Paula

From: Webb, Allison
Sent: October-31-18 10:31 PM
To: Thomson, Andrew
Subject: Media interest on sea lice story this eve

Heads up that our staff have been on the CTV and Global news this eve on the sea lice story along with Living Oceans Society. I'd expect more calls tomorrow. I've written a ROCS para for Jena and we'll be on the MINO call tomorrow am where this will be discussed. Tx Andy, Allison

Paylor, Adrienne

From: Paylor, Adrienne
Sent: October-31-18 11:06 AM
To: Sandberg, Krista
Subject: FW: RE reaction to reports on sea lice in Clayoquot Sound

FYI

From: Webb, Allison
Sent: October-31-18 10:47 AM
To: Bate, Dan
Cc: Paylor, Adrienne
Subject: Re: RE reaction to reports on sea lice in Clayoquot Sound

Adrienne Paylor. Thx.

Sent from my BlackBerry 10 smartphone on the Bell network.

From: Bate, Dan
Sent: Wednesday, October 31, 2018 10:26 AM
To: Webb, Allison
Cc: Rainer, Michelle
Subject: RE: RE reaction to reports on sea lice in Clayoquot Sound

Hi Allison - we have some follow-up questions from a reporter to our responses from yesterday.

Can you let me know who would be best to work with on your team? (Michelle Rainer is out on the Fish Heath Audit visit today).

Thanks much,
Dan

From: [REDACTED]
Sent: October-31-18 4:36 AM
To: Bate, Dan
Cc: Rainer, Michelle
Subject: RE reaction to reports on sea lice in Clayoquot Sound

Good morning and thank you for the response.. As I work to put together a piece, could you also provide your comments on these issues raised in the report..

Is this statement true..

"Sea lice are "out of control" at salmon farms on the west coast of B.C. this year because they have become drug resistant"

Is this an accurate depiction..

s.19(1)

The report claims Fisheries and Oceans Canada knew as early as 2014 that resistance was developing in sea lice, but did not take measures to ensure the protection of wild juvenile salmon from the parasite. Measures could have included alternate treatments for sea lice ready for deployment when SLICE failed,

The DFO has been contacted to comment on these claims, but the Vancouver Sun has not yet received a response. Cermaq has also been contacted. **Neither release public records of the drug treatments used on farmed salmon.**

"Eighteen years after this issue was brought to DFO's attention there is still no protection for wild salmon," said [REDACTED] one of the report's authors with Raincoast Research, and an outspoken critic of salmon farming.

From: Bate, Dan <Dan.Bate@dfo-mpo.gc.ca>
Sent: October 30, 2018 3:43 PM
To: [REDACTED]
Cc: Rainer, Michelle
Subject: RE: reaction to reports on sea lice in Clayoquot Sound

Hi [REDACTED] - Heard you were looking for info on the release of a recent report on sea lice. Sending along our key messaging on this issue.

Thanks,
Dan

- Seasonal and year-to-year variations in environmental parameters (eg.ocean salinity and temperature) and the number and species composition of wild salmon returns to an area are known to influence the abundance of sea lice on farms.
- In Clayoquot sound over the winter/spring of 2017-2018, the typical drop in salinity that comes with rains did not occur. This higher salinity resulted in increased lice production in the region and exacerbated the lice levels on farms.
- Earlier this year, Fisheries and Oceans Canada (DFO) collected sea lice from Cermaq Canada's Bawden site in the Clayoquot area and sent them to the BC Centre for Aquatic Health Sciences for analysis, which confirmed SLICE resistance. Those lice were later sent to researchers at the Atlantic Veterinary College who are undertaking work to better understand the genetic basis for SLICE resistance.
- The Department also initiated a review, which is still ongoing, of Cermaq Canada's sea lice management practices in this region to determine if relevant licence conditions have been followed appropriately.
- Under the Pacific Aquaculture Regulations, DFO requires salmon farming companies to regularly monitor and manage sea lice levels at their facilities in BC. DFO also regularly conducts assessments of sea lice abundance at these facilities.
- Companies in BC must submit a lice reduction plan if monitoring shows sea lice levels higher than three motile sea lice per farmed fish during the wild salmon outmigration period from March 1 to June 30 of each year. Motile lice are those at the free-moving stages of their life cycle.
- During most years, more than 90% of sites in BC are below the regulatory thresholds for sea lice during the wild salmon outmigration period (from March 1 to June 30 of each year). However, there were documented failures of SLICE treatment at Klemtu in 2013 and Esperanza Inlet in 2017 and now Clayoquot Sound in 2018.

- DFO is keeping a close eye on the issue of SLICE resistance. Research is under way, by DFO, industry, and academia, to find alternative methods to manage sea lice, and to better predict and track SLICE resistance. For instance, DFO is currently studying, or supporting research on, the use of Pacific perch as “cleaner fish” that eat sea lice off farmed fish and warm water baths to kill sea lice. More information on these projects can be found at www.dfo-mpo.gc.ca/aquaculture/sci-res/rd-eng.htm
- DFO is also supporting the licensing and approval process for alternative sea lice treatments, which are a necessary part of an integrated pest management approach.

About SLICE and hydrogen peroxide treatments:

- Salmon farming companies use an in-feed therapeutant called SLICE (emamectin benzoate) to reduce lice abundance. In British Columbia to date, SLICE has generally been a very effective tool in the management of sea lice at salmon farms.
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- Hydrogen peroxide is widely used on Canada’s east and west coast, and elsewhere in the world to remove sea lice from cultured fish. This pesticide is not absorbed by the fish and is non-toxic to humans. It also dissipates as a neutralized substance quickly in the environment, causing no discernible far-field effect.

Dan Bate

Team Lead, Communications
Fisheries and Oceans Canada Pacific Region / Canadian Coast Guard / Government of Canada
Dan.Bate@dfo-mpo.gc.ca

Chef d’équipe, communications
Pêches et Océans Canada, région du Pacifique / Garde côtière canadienne / Gouvernement du Canada
Dan.Bate@dfo-mpo.gc.ca

From: [REDACTED]
Sent: October-30-18 12:34 PM
To: NCR Media RCN (DFO/MPO)
Cc: Lubczuk, Jocelyn
Subject: reaction to reports on sea lice in Clayoquot Sound

Good morning... [REDACTED] SeawestNews here

seeking DFO comments and reactions to this news report in the Vancouver SUN
<https://vancouversun.com/news/local-news/drug-resistant-sea-lice-out-of-control-on-b-c-coast-report>

which is based on this report by Living Oceans
https://livingoceans.org/sites/default/files/Lice%20report%20final_0.pdf

s.19(1)

Paylor, Adrienne

From: Paylor, Adrienne
Sent: October-31-18 12:14 PM
To: Sandberg, Krista
Subject: RE: media query, re Cermaq and sea lice

Can you check?

From: Sandberg, Krista
Sent: October-31-18 12:12 PM
To: Paylor, Adrienne
Subject: RE: media query, re Cermaq and sea lice

Yes, that is accurate but I think Esperanza is 2016 and potentially Nootka in 2015

Krista Sandberg
Office | Bureau 250-286-5835
Cellular | Cellulaire [REDACTED]



Government
of Canada

Gouvernement
du Canada

Canada

From: Paylor, Adrienne
Sent: October-31-18 12:07 PM
To: Sandberg, Krista
Subject: FW: media query, re Cermaq and sea lice

- Not sure if this all got approved but Zac had said in this bullet below that : During most years, more than 90% of sites in BC are below the regulatory thresholds for sea lice during the wild salmon outmigration period (from March 1 to June 30 of each year). However, there were documented failures of SLICE treatment at Klemtu in 2015 and Esperanza Inlet in 2017 and now Clayoquot Sound in 2018.

Is this true?

From: Rainer, Michelle
Sent: September-20-18 3:52 PM
To: Paylor, Adrienne
Subject: FW: media query, re Cermaq and sea lice

Issue: [REDACTED] Globe and Mail [REDACTED]. I'm working on a story about Cermaq closing one of its sites, apparently in relation to sea lice concerns. Given the level of sea lice infestations in Clayoquot Sound this year, is DFO doing any additional monitoring or enforcement in the area?

Deadline: Thursday, September 20 at 5 p.m.
Approved by: Zac Waddington

- DFO is very confident in the monitoring being done in the Clayoquot area by environmental non-government groups, including Cedar Coast Field Station and third party environmental consultants hired by Cermaq. For this reason, DFO determined that additional monitoring by the Department would not contribute significantly to the understanding of the sea lice situation in Clayoquot.

s.16(2)(c)

s.19(1)

- Instead, DFO resources were allocated to performing an independent bioassay and supporting ongoing research to determine the genetic basis for SLICE resistance. SLICE is an in-feed therapeutant that BC salmon farming companies use to reduce lice abundance.
- DFO is keeping a close eye on the issue of SLICE resistance. The Department collected sea lice from Cermaq Canada's Bawden site in the Clayoquot area and sent them to the BC Centre for Aquatic Health Sciences for analysis, which confirmed SLICE resistance. Those lice were later sent to Mark Fast, a researcher out of Atlantic Veterinary College who is undertaking work to better understand the genetic basis for SLICE resistance.
- During most years, more than 90% of sites in BC are below the regulatory thresholds for sea lice during the wild salmon outmigration period (from March 1 to June 30 of each year). However, there were documented failures of SLICE treatment at Klemtu in 2015 and Esperanza Inlet in 2017 and now Clayoquot Sound in 2018.
- Research is under way, by DFO, industry, and academia, to find alternative methods to manage sea lice, and to better predict and track SLICE resistance. For instance, DFO is currently studying, or supporting research on, the use of Pacific perch as "cleaner fish" that eat sea lice off farmed fish and warm water baths to kill sea lice. More information on these projects can be found at www.dfo-mpo.gc.ca/aquaculture/sci-res/rd-eng.htm.
- DFO is also supporting the licensing and approval process for alternative sea lice treatments, which are a necessary part of an integrated pest management approach.

From: Waddington, Zac
Sent: September-20-18 1:47 PM
To: Rainer, Michelle; Jones, Simon; Paylor, Adrienne
Subject: RE: media query, re Cermaq and sea lice

We are not doing any additional monitoring. We did discuss this possibility; however we are very confident in the monitoring taking place by various eNGO's in the area (one of whom I've spoken with), and third party environmental consultants hired by Cermaq. Unfortunately, we know from past experiences where lice levels have been unmanaged that it does correlate to higher lice levels on out migrating smolts. It was decided that our additional monitoring would not contribute significantly to the understanding of the lice situation in Clayoquot.

That said, we did conduct an independent bioassay (test of SLICE resistance in the lice) using lice from a farm affected with SLICE resistance and significant lice burden. That bioassay confirmed resistance, and the lice from that test were sent to a researcher to help support some genetics work that is being done to better understand the genetic basis for resistance.

Hope that helps,

Zac

From: Rainer, Michelle
Sent: September-20-18 1:25 PM
To: Jones, Simon; Waddington, Zac; Paylor, Adrienne
Subject: FW: media query, re Cermaq and sea lice
Importance: High

Hi there,

Looks like she has all the info she needs from Cermaq about reasons for the closure. Can any of you provide a response to her questions about monitoring in the area? Her deadline is this afternoon so hoping for a quick turnaround 😊.

Thanks,
Michelle

From: [REDACTED]
Sent: September-20-18 11:21 AM
To: Rainer, Michelle
Subject: RE: media query, re Cermaq and sea lice

Hi Michelle, thanks for your email.
I did speak to Cermaq this morning.
The infographic is informative.

A follow-up question:

- Given the level of sea lice infestations in Clayoquot Sound this year, is DFO doing any additional monitoring or enforcement in the area?

From: Rainer, Michelle [mailto:Michelle.Rainer@dfo-mpo.gc.ca]
Sent: Wednesday, September 19, 2018 3:49 PM
To: [REDACTED]
Subject: RE: media query, re Cermaq and sea lice

Hi [REDACTED]

I have confirmed that Cermaq's decision isn't as a result of any directive from DFO so the company is the best source of info for the reasoning behind the closure. If you have any questions for us after speaking to them, can you please submit them in writing?

I've attached an infographic we've recently made that explains *L. salmonis* (the salmon louse) monitoring and regulations. I hope you find this useful as background. It's new and you're the first person outside of DFO who will have seen it, so I would welcome your feedback if there's anything you find confusing!

Regards,
Michelle Rainer
Communications Advisor | Conseillère en communications
Fisheries and Oceans Canada | Pêches et Océans Canada
200 - 401 Burrard Street, Vancouver, B.C. V6C 3S4 | 200 - 401 rue Burrard, Vancouver, C.-B. V6C 3S4
Telephone | Téléphone 604-775-5065

From: [REDACTED]
Sent: September-19-18 2:17 PM
To: Rainer, Michelle
Subject: RE: media query, re Cermaq and sea lice

Thanks.
No release as far as I know.
I learned about it here:
<https://hashilthsa.com/news/2018-09-17/high-sea-lice-counts-leads-cermag-close-farm-site-clayoquot-sound>
I spoke to Cermaq briefly today and was told two letters had been sent out on the issue. I requested them but have not yet received them.

s.19(1)

From: Rainer, Michelle [mailto:Michelle.Rainer@dfo-mpo.gc.ca]
Sent: Wednesday, September 19, 2018 2:15 PM
To: [REDACTED]
Subject: RE: media query, re Cermaq and sea lice

Hi [REDACTED]
I will look into it for you. Was there some sort of release about this?
Thanks,
Michelle

From: [REDACTED]
Sent: September-19-18 1:49 PM
To: RHQ - Media.PAC
Subject: media query, re Cermaq and sea lice

Good day.
My name is [REDACTED] reporter with the Globe and Mail.
I'm working on a story about Cermaq closing one of its sites, apparently in relation to sea lice concerns. (I haven't yet talked directly to the company but I have put in a request.)
I'm hoping to speak to someone at DFO about this development and about sea lice concerns in general.
My deadline to speak to someone is 4 pm Pacific time tomorrow – Thursday September 20.
I can be reached via email or at [REDACTED]
Thank you,

- [REDACTED]



s.19(1)

Bate, Dan

From: NCR Media RCN (DFO/MPO)
Sent: October-31-18 12:27 PM
To: Girouard, Louise; Bate, Dan; Smith, Kathleen
Cc: Saindon, Carole; Chow, Vance; Smith, Kathleen; Quinn, Caroline; Mayrand, Benoit; Stanek, Frank; Fagan, Ashley
Subject: Global News BC request for comment
Attachments: Sea Lice Media Release (002).docx

Importance: High

Hi – I will send this MINO to see if they want to respond or if they prefer the Region respond with messaging approved last night.

Regards

Frank

From: [REDACTED]
Sent: October-31-18 3:16 PM
To: NCR Media RCN (DFO/MPO)
Subject: Global News request for comment

Hello,

I'm hoping the Minister can provide a comment on a story we are working on. It concerns a report from Living Oceans saying that the DFO has seen evidence showing sea lice have developed a resistance to SLICE since 2014 – but denied that the evidence existed. Furthermore, the report says that the DFO then withheld evidence from the Minister of Agriculture's Advisory Committee on Finfish Aquaculture in 2017 – 2018.

I have attached the report.

Would you be able to respond to those claims.

And as well provide what action, if any, the government is taking on this alleged issue? And if any additional research and information can be available to Global News so that we can be accurate with our story?

Thank you so much,

[REDACTED]

s.19(1)

**Pages 1360 to / à 1361
are duplicates of
sont des duplicatas des
pages 1365 to / à 1366**

Bate, Dan

From: Stanek, Frank
Sent: October-31-18 12:38 PM
To: Lubczuk, Jocelyn; Des Rosiers, Marie-Pascale
Cc: Mitchell, Laura; Young, George; O'Grady, Samantha; Knudsen, Mark; Tran, Thi; Choeurng, Stephanie; Windsor, Victoria; Kahn, Zoe; Jarjour, Jasmine; Hirani, Samia; Khwaja, Saba; Turple, Justin; Belle-Isle, Alain; Butcher, Ashley; Hubley, Marian; Quinn, Caroline; Smith, Kathleen; Fagan, Ashley; Girouard, Louise; DFO.R PAC Communications Advisors / Conseillers Communications PAC R.MPO; Saindon, Carole; Chow, Vance; Mayrand, Benoit; Eatmon, Keegan; NCR Media RCN (DFO/MPO); Szerze, Anita; Seguin, Natalie
Subject: Global News (BC) request for comment - Living Oceans report
Attachments: Sea Lice Media Release (002).docx

Hi Jocelyn. Please see enclosed request. Please advise if your office would like to respond or have PAC Communications reply with previously approved messaging (below).

Regards

Frank

From: [REDACTED]
Sent: October-31-18 3:16 PM
To: NCR Media RCN (DFO/MPO)
Subject: Global News request for comment

Hello,

I'm hoping the Minister can provide a comment on a story we are working on. It concerns a report from Living Oceans saying that the DFO has seen evidence showing sea lice have developed a resistance to SLICE since 2014 – but denied that the evidence existed. Furthermore, the report says that the DFO then withheld evidence from the Minister of Agriculture's Advisory Committee on Finfish Aquaculture in 2017 – 2018.

I have attached the report.

Would you be able to respond to those claims.

And as well provide what action, if any, the government is taking on this alleged issue? And if any additional research and information can be available to Global News so that we can be accurate with our story?

Thank you so much,



Issue: Living Oceans Society [REDACTED] released a report on sea lice and SLICE resistance in the Clayoquot today <https://livingoceans.org/action/sea-lice-out-control> Recent coverage here: <https://vancouver.sun.com/news/local-news/drug-resistant-sea-lice-out-of-control-on-b-c-coast-report>

Media requests from:

[redacted], Vancouver Sun (short web report),
[redacted], Vancouver Sun (longer story),
[redacted], SeaWestNews, [redacted]

Deadline: Tuesday, October 30, 4:00 p.m. PST

Approved by: Zac Waddington, Simon Jones, Allison Webb, Louise Girouard, Andy Thompson (A/RDG)

Media lines:

- Seasonal and year-to-year variations in environmental parameters (eg. ocean salinity and temperature) and the number and species composition of wild salmon returns to an area are known to influence the abundance of sea lice on farms. **Approved**
- In Clayoquot sound over the winter/spring of 2017-2018, the typical drop in salinity that comes with rains did not occur. This higher salinity resulted in increased lice production in the region and exacerbated the lice levels on farms. **New**
- Earlier this year, Fisheries and Oceans Canada (DFO) collected sea lice from Cermaq Canada's Bawden site in the Clayoquot area and sent them to the BC Centre for Aquatic Health Sciences for analysis, which confirmed SLICE resistance. Those lice were later sent to researchers at the Atlantic Veterinary College who are undertaking work to better understand the genetic basis for SLICE resistance. **Approved**
- The Department also initiated a review, which is still ongoing, of Cermaq Canada's sea lice management practices in this region to determine if relevant licence conditions have been followed appropriately. **Approved**
- Under the Pacific Aquaculture Regulations, DFO requires salmon farming companies to regularly monitor and manage sea lice levels at their facilities in BC. DFO also regularly conducts assessments of sea lice abundance at these facilities. **Approved**
- Companies in BC must submit a lice reduction plan if monitoring shows sea lice levels higher than three motile sea lice per farmed fish during the wild salmon outmigration period from March 1 to June 30 of each year. Motile lice are those at the free-moving stages of their life cycle. **Approved**
- During most years, more than 90% of sites in BC are below the regulatory thresholds for sea lice during the wild salmon outmigration period (from March 1 to June 30 of each year). However, there were documented failures of SLICE treatment at Klemtu in 2013 and Esperanza Inlet in 2017 and now Clayoquot Sound in 2018. **Approved**
- DFO is keeping a close eye on the issue of SLICE resistance. Research is under way, by DFO, industry, and academia, to find alternative methods to manage sea lice, and to better predict and track SLICE resistance. For instance, DFO is currently studying, or supporting research on, the use of Pacific perch as "cleaner fish" that eat sea lice off farmed fish and warm water baths to kill sea lice. More information on these projects can be found at www.dfo-mpo.gc.ca/aquaculture/sci-res/rd-eng.htm **Approved**
- DFO is also supporting the licensing and approval process for alternative sea lice treatments, which are a necessary part of an integrated pest management approach. **Approved**

About SLICE and hydrogen peroxide treatments:

- Salmon farming companies use an in-feed therapeutant called SLICE (emamectin benzoate) to reduce lice abundance. In British Columbia to date, SLICE has generally been a very effective tool in the management of sea lice at salmon farms. **Approved**
- The rotational use of hydrogen peroxide with SLICE on farms is a key component of Integrated Pest Management (IPM). IPM aims to control pests with minimal reliance on drugs/pesticides and prevent the development of resistance. **New**

- Hydrogen peroxide is widely used on Canada's east and west coast, and elsewhere in the world to remove sea lice from cultured fish. This pesticide is not absorbed by the fish and is non-toxic to humans. It also dissipates as a neutralized substance quickly in the environment, causing no discernible far-field effect. **Approved**

No information has been removed or severed from this page



Media Release

October 30, 2018

DFO Misled Ministerial Advisory Council

Senior DFO officials failed to advise that parasitic salmon lice are resistant to the only drug approved to treat them.

Vancouver: A report issued today by Living Oceans and Raincoast Research reveals that senior DFO officials misled the B.C. Minister of Agriculture's Advisory Council on Finfish Aquaculture during deliberations leading up to its January, 2018 report on salmon farming. Documents obtained through Access to Information disclose that DFO knew that parasitic salmon lice had developed resistance to the only drug approved to treat them, SLICE; but remained silent while the Advisory Council was told that there is no evidence of such drug resistance in B.C.

The control of sea lice is critical to the protection of wild salmon and was an important issue in the Council's advice to the Minister of Agriculture. Without an effective oral medication, salmon farmers will have to control lice with chemical baths which are subsequently dumped directly into the ocean.

"Eighteen years after this issue was brought to DFO's attention there is still no protection for wild salmon," said [REDACTED] of Raincoast Research. "Independent researchers in Clayoquot Sound documented 96% of the wild juvenile salmon were infected with an average of over 8 lice per fish. One of the fish they recovered had 50 lice. I don't hold hope that much of this generation of wild salmon survived."

Living Oceans and Raincoast were each independently made aware of the soaring lice levels in Clayoquot this spring. [REDACTED] visited the region to photograph the juveniles, while Living Oceans contested Cermaq Canada's continued use of the Aquaculture Stewardship Certification logo on their product. The company eventually withdrew voluntarily from using the logo and was subsequently suspended by the ASC.

More troubling than the evolution of drug resistance is the response of DFO to the crisis. "DFO first began to see SLICE-resistance building in lice in the Broughton Archipelago in 2014. They first denied that the evidence existed; then they withheld evidence from the Minister of Agriculture's Advisory Committee on Finfish Aquaculture in 2017-2018. Throughout that time, DFO did not take measures to ensure that salmon farmers would have alternate treatments for sea lice ready for deployment when SLICE resistance resulted in failure to control lice in 2018."

The groups are calling on the Minister of Fisheries and Oceans, Jonathan Wilkinson, to transition the industry out of open ocean netpens and into land-based, closed containment. "We are now faced with a situation where the only way to control sea lice on netpen salmon farms includes dumping toxic chemicals directly into the ocean," said [REDACTED] "No other form

of agriculture is allowed to deliberately introduce toxins into public waters. We're asking the Minister to stop treating the ocean like a sewer.”

-30-

Contact:

[REDACTED] Living Oceans Society, [REDACTED]

[REDACTED] Raincoast Research, [REDACTED]

Read the report here.

s.19(1)

Paylor, Adrienne

From: Paylor, Adrienne
Sent: October-31-18 1:29 PM
To: McConnachie, Sarah
Subject: RE: RE reaction to reports on sea lice in Clayoquot Sound

Awesome thanks ☺

From: McConnachie, Sarah
Sent: October-31-18 1:27 PM
To: Paylor, Adrienne
Subject: RE: RE reaction to reports on sea lice in Clayoquot Sound

See bolded and highlighted

From: Paylor, Adrienne
Sent: October-31-18 1:18 PM
To: McConnachie, Sarah
Subject: FW: RE reaction to reports on sea lice in Clayoquot Sound

Ok some bullets to review.....

Is this statement true..

"Sea lice are "out of control" at salmon farms on the west coast of B.C. this year because they have become drug resistant"

- Sea lice abundance is monitored at all active farm sites in BC and a proportion are audited by the department of Fisheries and Oceans on a quarterly basis. All sea lice abundance data and audit results are publically reported (**maybe state how often reports are given**).
- During most years, more than 90% of sites in BC are below the regulatory thresholds for sea lice during the wild salmon outmigration period (from March 1 to June 30 of each year).
- All sites culturing Atlantic Salmon in the Clayoquot region were over threshold during the 2018 outmigration period and 3 sites in the Nootka area. No facilities were over threshold in other zones.
- Abundance data from past years have indicated exceedance of the sea lice regulatory threshold in certain areas which DFO regulators have watched carefully for indication of SLICE resistance.
- All these past areas of exceedance have shown they are able to manage lice with effective treatments of SLICE in following years. From 2011-2017 approximately 90% of SLICE treatments have shown acceptable efficacy, and when reduced efficacy was observed alternative treatments such as hydrogen peroxide have been implemented
- Prior to 2017, more than 95% of SLICE treatments in the Clayoquot area were considered to be effective. DFO data has demonstrated that any indication of resistance has disappeared in every area where concern has been indicated through audit numbers or reported to DFO by industry in the past.
- Wild Salmon returning from the open ocean carry sea lice that have never been exposed to SLICE and **these are transferred to** farmed fish. This replenishes the genetics in the sea lice population that could develop resistance to SLICE. This allows the farm treatments to become effective again the following year.

- DFO has been working with the province of BC and industry to develop alternative tools to manage sea lice
- In cases where the use of SLICE does not result in adequate reduction of sea lice, companies can apply to the province of British Columbia for a permit to use alternative treatments, including Paramove (a hydrogen peroxide bath). Please contact Cermaq or the Province of BC's Ministry of Environment for further information on this process.
- Hydrogen peroxide is used widely world-wide, including elsewhere on Canada's west coast, with excellent **efficacy** and no demonstrable effects to the ecosystem. This pesticide is not absorbed by the fish and is non-toxic to humans. It also dissipates as a neutralized substance (**oxygen and water**) quickly in the environment, causing no discernible far-field effect

Is this an accurate depiction..

The report claims Fisheries and Oceans Canada knew as early as 2014 that resistance was developing in sea lice, but did not take measures to ensure the protection of wild juvenile salmon from the parasite.

Measures could have included alternate treatments for sea lice ready for deployment when SLICE failed,

- This is not an accurate depiction.
- DFO has been actively monitoring and analysis sea lice data for indication of SLICE resistance since 2011 and first noticed concerns for Klemtu in 2015 and Esperanza Inlet in 2017 and now Clayoquot Sound in 2018.
- Since the monitoring numbers in Clayoquot Sound from this spring indicated the significant SLICE resistance problem to date, DFO for the first time ever collected sea lice samples from Cermaq Canada's Bawden site and sent them to the BC Centre for Aquatic Health Sciences for analysis. SLICE resistance was confirmed. Those lice were later sent to Mark Fast, a researcher out of Atlantic Veterinary College who is undertaking work to better understand the genetic basis for SLICE resistance.

The DFO has been contacted to comment on these claims, but the Vancouver Sun has not yet received a response. Cermaq has also been contacted. **Neither release public records of the drug treatments used on farmed salmon.**

"Eighteen years after this issue was brought to DFO's attention there is still no protection for wild salmon," said [REDACTED] one of the report's authors with Raincoast Research, and an outspoken critic of salmon farming.

From: Bate, Dan <Dan.Bate@dfo-mpo.gc.ca>

Sent: October 30, 2018 3:43 PM

To: [REDACTED]

Cc: Rainer, Michelle

Subject: RE: reaction to reports on sea lice in Clayoquot Sound

Hi [REDACTED] Heard you were looking for info on the release of a recent report on sea lice. Sending along our key messaging on this issue.

Thanks,
Dan

s.19(1)

- Seasonal and year-to-year variations in environmental parameters (eg. ocean salinity and temperature) and the number and species composition of wild salmon returns to an area are known to influence the abundance of sea lice on farms.
- In Clayoquot sound over the winter/spring of 2017-2018, the typical drop in salinity that comes with rains did not occur. This higher salinity resulted in increased lice production in the region and exacerbated the lice levels on farms.
- Earlier this year, Fisheries and Oceans Canada (DFO) collected sea lice from Cermaq Canada's Bawden site in the Clayoquot area and sent them to the BC Centre for Aquatic Health Sciences for analysis, which confirmed SLICE resistance. Those lice were later sent to researchers at the Atlantic Veterinary College who are undertaking work to better understand the genetic basis for SLICE resistance.
- The Department also initiated a review, which is still ongoing, of Cermaq Canada's sea lice management practices in this region to determine if relevant licence conditions have been followed appropriately.
- Under the Pacific Aquaculture Regulations, DFO requires salmon farming companies to regularly monitor and manage sea lice levels at their facilities in BC. DFO also regularly conducts assessments of sea lice abundance at these facilities.
- Companies in BC must submit a lice reduction plan if monitoring shows sea lice levels higher than three motile sea lice per farmed fish during the wild salmon outmigration period from March 1 to June 30 of each year. Motile lice are those at the free-moving stages of their life cycle.
- During most years, more than 90% of sites in BC are below the regulatory thresholds for sea lice during the wild salmon outmigration period (from March 1 to June 30 of each year). However, there were documented failures of SLICE treatment at Klemtu in 2013 and Esperanza Inlet in 2017 and now Clayoquot Sound in 2018.
- DFO is keeping a close eye on the issue of SLICE resistance. Research is under way, by DFO, industry, and academia, to find alternative methods to manage sea lice, and to better predict and track SLICE resistance. For instance, DFO is currently studying, or supporting research on, the use of Pacific perch as "cleaner fish" that eat sea lice off farmed fish and warm water baths to kill sea lice. More information on these projects can be found at www.dfo-mpo.gc.ca/aquaculture/sci-res/rd-eng.htm
- DFO is also supporting the licensing and approval process for alternative sea lice treatments, which are a necessary part of an integrated pest management approach.

About SLICE and hydrogen peroxide treatments:

- Salmon farming companies use an in-feed therapeutant called SLICE (emamectin benzoate) to reduce lice abundance. In British Columbia to date, SLICE has generally been a very effective tool in the management of sea lice at salmon farms.
- The rotational use of hydrogen peroxide with SLICE on farms is a key component of Integrated Pest Management (IPM). IPM aims to control pests with minimal reliance on drugs/pesticides and prevent the development of resistance.
- Hydrogen peroxide is widely used on Canada's east and west coast, and elsewhere in the world to remove sea lice from cultured fish. This pesticide is not absorbed by the fish and is non-toxic to humans. It also dissipates as a neutralized substance quickly in the environment, causing no discernible far-field effect.

Dan Bate

Team Lead, Communications

Fisheries and Oceans Canada Pacific Region / Canadian Coast Guard / Government of Canada

Dan.Bate@dfo-mpo.gc.ca

Chef d'équipe, communications

Pêches et Océans Canada, région du Pacifique / Garde côtière canadienne / Gouvernement du Canada

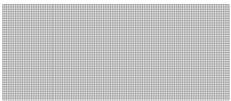
Dan.Bate@dfo-mpo.gc.ca

From: [REDACTED]
Sent: October-30-18 12:34 PM
To: NCR Media RCN (DFO/MPO)
Cc: Lubczuk, Jocelyn
Subject: reaction to reports on sea lice in Clayoquot Sound

Good morning... [REDACTED] SeawestNews here

seeking DFO comments and reactions to this news report in the Vancouver SUN
<https://vancouversun.com/news/local-news/drug-resistant-sea-lice-out-of-control-on-b-c-coast-report>

which is based on this report by Living Oceans
https://livingoceans.org/sites/default/files/Lice%20report%20final_0.pdf



s.19(1)

Bate, Dan

From: Paylor, Adrienne
Sent: October-31-18 2:13 PM
To: Bate, Dan
Subject: FW: RE reaction to reports on sea lice in Clayoquot Sound

The DFO has been contacted to comment on these claims, but the Vancouver Sun has not yet received a response. Cermaq has also been contacted. **Neither release public records of the drug treatments used on farmed salmon.**

- Incorrect statement
- In BC under DFO's Pacific Aquaculture Regulations all infested treatments are publicly reported in the sea lice abundance reports on line.
- Also under the national Aquaculture Activities Regulations (AAR) DFO publicly reports the quantity of all drugs and pesticides deposited at each aquaculture facility. This information is posted on an annually bases starting in 2016 when the regulation came into effect. The 2017 report is currently being processed for posting.

"Eighteen years after this issue was brought to DFO's attention there is still no protection for wild salmon," said [REDACTED] one of the report's authors with Raincoast Research, and an outspoken critic of salmon farming.

- The protection and conservation of wild fish is a priority for Fisheries and Oceans Canada (DFO).
- DFO is committed to ensuring that Canada's aquaculture regulations support the health of marine ecosystems and the aquatic species they support.
- In British Columbia, the aquaculture industry operates under some of the strictest regulations in the world, and the Department is working with provincial partners, First Nations, industry, and communities on legislative reforms, as recommended by the Standing Senate Committee on Fisheries and Oceans.
- DFO's Aquaculture in British Columbia website outlines DFO's regulations, environmental management requirements and compliance and monitoring activities, which are in place to ensure that the industry operates in a sustainable manner.
- Requirements include fish health management plans, fish health and compliance monitoring, escape prevention requirements, sea lice management, incidental catch reporting, and mitigation and monitoring of habitat impacts and environmental effects. Aquaculture in British Columbia website: <http://www.pac.dfo-mpo.gc.ca/aquaculture/index-eng.html>
- The Department prides itself on maintaining an objective science research program, focused on DFO's priority issues. Results of this research are peer-reviewed and published in international scientific journals. DFO scientists take into account all peer-reviewed science of which they are aware.
- DFO's Aquaculture science and research website includes detailed information on past and current research related to aquaculture. For a more comprehensive list of early aquaculture research, please refer to the provincial government's Salmon Aquaculture Review bibliography. Aquaculture science website: <http://www.dfo-mpo.gc.ca/aquaculture/science-eng.html>. Salmon Aquaculture Review website: http://www.eao.gov.bc.ca/files/ea_review/SAR_summary_report_vol5.pdf

s.19(1)

From: Bate, Dan <Dan.Bate@dfo-mpo.gc.ca>
Sent: October 30, 2018 3:43 PM
To: [REDACTED]
Cc: Rainer, Michelle
Subject: RE: reaction to reports on sea lice in Clayoquot Sound

Hi [REDACTED] - Heard you were looking for info on the release of a recent report on sea lice. Sending along our key messaging on this issue.

Thanks,
Dan

- Seasonal and year-to-year variations in environmental parameters (eg. ocean salinity and temperature) and the number and species composition of wild salmon returns to an area are known to influence the abundance of sea lice on farms.
- In Clayoquot sound over the winter/spring of 2017-2018, the typical drop in salinity that comes with rains did not occur. This higher salinity resulted in increased lice production in the region and exacerbated the lice levels on farms.
- Earlier this year, Fisheries and Oceans Canada (DFO) collected sea lice from Cermaq Canada's Bawden site in the Clayoquot area and sent them to the BC Centre for Aquatic Health Sciences for analysis, which confirmed SLICE resistance. Those lice were later sent to researchers at the Atlantic Veterinary College who are undertaking work to better understand the genetic basis for SLICE resistance.
- The Department also initiated a review, which is still ongoing, of Cermaq Canada's sea lice management practices in this region to determine if relevant licence conditions have been followed appropriately.
- Under the Pacific Aquaculture Regulations, DFO requires salmon farming companies to regularly monitor and manage sea lice levels at their facilities in BC. DFO also regularly conducts assessments of sea lice abundance at these facilities.
- Companies in BC must submit a lice reduction plan if monitoring shows sea lice levels higher than three motile sea lice per farmed fish during the wild salmon outmigration period from March 1 to June 30 of each year. Motile lice are those at the free-moving stages of their life cycle.
- During most years, more than 90% of sites in BC are below the regulatory thresholds for sea lice during the wild salmon outmigration period (from March 1 to June 30 of each year). However, there were documented failures of SLICE treatment at Klemtu in 2013 and Esperanza Inlet in 2017 and now Clayoquot Sound in 2018.
- DFO is keeping a close eye on the issue of SLICE resistance. Research is under way, by DFO, industry, and academia, to find alternative methods to manage sea lice, and to better predict and track SLICE resistance. For instance, DFO is currently studying, or supporting research on, the use of Pacific perch as "cleaner fish" that eat sea lice off farmed fish and warm water baths to kill sea lice. More information on these projects can be found at www.dfo-mpo.gc.ca/aquaculture/sci-res/rd-eng.htm
- DFO is also supporting the licensing and approval process for alternative sea lice treatments, which are a necessary part of an integrated pest management approach.

About SLICE and hydrogen peroxide treatments:

- Salmon farming companies use an in-feed therapeutant called SLICE (emamectin benzoate) to reduce lice abundance. In British Columbia to date, SLICE has generally been a very effective tool in the management of sea lice at salmon farms.
- The rotational use of hydrogen peroxide with SLICE on farms is a key component of Integrated Pest Management (IPM). IPM aims to control pests with minimal reliance on drugs/pesticides and prevent the development of resistance.

- Hydrogen peroxide is widely used on Canada's east and west coast, and elsewhere in the world to remove sea lice from cultured fish. This pesticide is not absorbed by the fish and is non-toxic to humans. It also dissipates as a neutralized substance quickly in the environment, causing no discernible far-field effect.

Dan Bate

Team Lead, Communications

Fisheries and Oceans Canada Pacific Region / Canadian Coast Guard / Government of Canada

Dan.Bate@dfo-mpo.gc.ca

Chef d'équipe, communications

Pêches et Océans Canada, région du Pacifique / Garde côtière canadienne / Gouvernement du Canada

Dan.Bate@dfo-mpo.gc.ca

From: [REDACTED]
Sent: October-30-18 12:34 PM
To: NCR Media RCN (DFO/MPO)
Cc: Lubczuk, Jocelyn
Subject: reaction to reports on sea lice in Clayoquot Sound

Good morning... [REDACTED] SeawestNews here

seeking DFO comments and reactions to this news report in the Vancouver SUN

<https://vancouversun.com/news/local-news/drug-resistant-sea-lice-out-of-control-on-b-c-coast-report>

which is based on this report by Living Oceans

https://livingoceans.org/sites/default/files/Lice%20report%20final_0.pdf



Sandberg, Krista

From: Sandberg, Krista
Sent: October-31-18 2:25 PM
To: Paylor, Adrienne
Subject: RE: RE reaction to reports on sea lice in Clayoquot Sound

11 sites

Krista Sandberg
Office | Bureau 250-286-5835
Cellular | Cellulaire [REDACTED]



Gouvernement
of Canada

Gouvernement
du Canada

Canada

From: Paylor, Adrienne
Sent: October-31-18 2:23 PM
To: Sandberg, Krista
Subject: FW: RE reaction to reports on sea lice in Clayoquot Sound

Is it 4 sites in Clayoquot that were over limit in out migration or more? See Communications changes and questions below

From: Bate, Dan
Sent: October-31-18 2:15 PM
To: Paylor, Adrienne
Subject: RE: RE reaction to reports on sea lice in Clayoquot Sound

Hi Adrian - my edits incorporated .. recommend we stick with the blue text below.
Would be helpful if we could detail the number of farms impacted in Clayoquot.

Dan

From: Paylor, Adrienne
Sent: October-31-18 1:40 PM
To: Bate, Dan
Subject: FW: RE reaction to reports on sea lice in Clayoquot Sound

Ok I think I need some help on this....here are some bullets to review but if I call you maybe we can clean this up over the phone?

Is this statement true..

"Sea lice are "out of control" at salmon farms on the west coast of B.C. this year because they have become drug resistant"

- Sea lice abundance is monitored at all active farm sites in BC and a portion are audited by the department of Fisheries and Oceans on a quarterly basis. All sea lice abundance data and audit results are publically reported.

s.16(2)(c)

- During most years, more than 90% of sites in BC are below the regulatory thresholds for sea lice during the wild salmon outmigration period (from March 1 to June 30 of each year).
 - DFO has been working with the province of BC and industry to develop alternative tools to manage sea lice
 - During the 2018 outmigration period, (#?) sites culturing Atlantic Salmon in the Clayoquot region and 3 sites in the Nootka area were identified with an over threshold of sea lice abundance.
 - Sites experiencing sea lice exceedance have been able to manage lice with effective treatments of SLICE in. From 2011-2017 approximately 90% of SLICE treatments have shown acceptable efficacy, and when reduced efficacy was observed alternative treatments such as Hydrogen Peroxide have been implemented.
 - DFO regulators have watched carefully for indication of SLICE resistance. In cases where the use of SLICE does not result in adequate reduction of sea lice, companies can apply to the province of British Columbia for a permit to use alternative treatments, including Paramove (a hydrogen peroxide bath). Please contact Cermaq or the Province of BC's Ministry of Environment for further information on this process.
 - Hydrogen peroxide is used widely world-wide, including elsewhere on Canada's west coast, with excellent efficacy and no demonstrable effects to the ecosystem. This pesticide is not absorbed by the fish and is non-toxic to humans. It also dissipates as a neutralized substance (oxygen and water) quickly in the environment, causing no discernible far-field effect
-
- ~~• Abundance data from past years have indicated exceedance of the sea lice regulatory threshold in certain areas which DFO regulators have watched carefully for indication of SLICE resistance.~~
 - ~~• Prior to 2017, more than 95% of SLICE treatments in the Clayoquot area were considered to be effective. DFO data has demonstrated that any indication of resistance has disappeared in every area where concern has been indicated through audit numbers or reported to DFO by industry in the past.~~
 - ~~• Wild Salmon returning from the open ocean carry sea lice that have never been exposed to SLICE and these are transferred to farmed fish. This replenishes the genetics in the sea lice population that could develop resistance to SLICE. This allows the farm treatments to become effective again the following year.~~

Is this an accurate depiction..

The report claims Fisheries and Oceans Canada knew as early as 2014 that resistance was developing in sea lice, but did not take measures to ensure the protection of wild juvenile salmon from the parasite.

Measures could have included alternate treatments for sea lice ready for deployment when SLICE failed,

- DFO has been actively monitoring and analysing sea lice data for indication of SLICE resistance since 2011 and first noted concerns at Klemtu in 2015, Esperanza Inlet in 2017, and now Clayoquot Sound in 2018.
- Since the monitoring numbers in Clayoquot Sound from this spring was the strongest indication of SLICE resistance to date, DFO took action to perform a targeted audit and collected sea lice samples from Cermaq Canada's Bawden site and sent them to the BC Centre for Aquatic Health Sciences for analysis. SLICE resistance was confirmed by the lab. Samples were later sent to the Atlantic Veterinary College which is currently undertaking work to better understand SLICE resistance.
- DFO has taken significant action and is currently investigating the management of lice at farms in Clayoquot by Cermaq Canada to determine if there has been non-compliance with the licence conditions. Due to the active investigation we cannot comment further at this time.

The DFO has been contacted to comment on these claims, but the Vancouver Sun has not yet received a response. Cermaq has also been contacted. **Neither release public records of the drug treatments used on farmed salmon.**

- In BC under DFO's Pacific Aquaculture Regulations all infested treatments are publicly reported in the sea lice abundance reports online.
- In addition, DFO publicly reports the quantity of all drugs and pesticides deposited at each aquaculture facility under the national Aquaculture Activities Regulations (AAR). This information is posted on an annual basis starting in 2016 when the regulation came into effect. The 2017 report is currently being processed for posting

"Eighteen years after this issue was brought to DFO's attention there is still no protection for wild salmon," said [REDACTED] one of the report's authors with Raincoast Research, and an outspoken critic of salmon farming.

From: Bate, Dan <Dan.Bate@dfo-mpo.gc.ca>
Sent: October 30, 2018 3:43 PM
To: [REDACTED]
Cc: Rainer, Michelle
Subject: RE: reaction to reports on sea lice in Clayoquot Sound

Hi [REDACTED] - Heard you were looking for info on the release of a recent report on sea lice. Sending along our key messaging on this issue.

Thanks,
Dan

- Seasonal and year-to-year variations in environmental parameters (eg ocean salinity and temperature) and the number and species composition of wild salmon returns to an area are known to influence the abundance of sea lice on farms.
- In Clayoquot sound over the winter/spring of 2017-2018, the typical drop in salinity that comes with rains did not occur. This higher salinity resulted in increased lice production in the region and exacerbated the lice levels on farms
- Earlier this year, Fisheries and Oceans Canada (DFO) collected sea lice from Cermaq Canada's Bawden site in the Clayoquot area and sent them to the BC Centre for Aquatic Health Sciences for analysis, which confirmed SLICE resistance. Those lice were later sent to researchers at the Atlantic Veterinary College who are undertaking work to better understand the genetic basis for SLICE resistance
- The Department also initiated a review, which is still ongoing, of Cermaq Canada's sea lice management practices in this region to determine if relevant licence conditions have been followed appropriately.
- Under the Pacific Aquaculture Regulations, DFO requires salmon farming companies to regularly monitor and manage sea lice levels at their facilities in BC. DFO also regularly conducts assessments of sea lice abundance at these facilities.
- Companies in BC must submit a lice reduction plan if monitoring shows sea lice levels higher than three motile sea lice per farmed fish during the wild salmon outmigration period from March 1 to June 30 of each year. Motile lice are those at the free-moving stages of their life cycle.

- During most years, more than 90% of sites in BC are below the regulatory thresholds for sea lice during the wild salmon outmigration period (from March 1 to June 30 of each year). However, there were documented failures of SLICE treatment at Klemtu in 2013 and Esperanza Inlet in 2017 and now Clayoquot Sound in 2018.
- DFO is keeping a close eye on the issue of SLICE resistance. Research is under way, by DFO, industry, and academia, to find alternative methods to manage sea lice, and to better predict and track SLICE resistance. For instance, DFO is currently studying, or supporting research on, the use of Pacific perch as "cleaner fish" that eat sea lice off farmed fish and warm water baths to kill sea lice. More information on these projects can be found at www.dfo-mpo.gc.ca/aquaculture/sci-res/rd-eng.htm
- DFO is also supporting the licensing and approval process for alternative sea lice treatments, which are a necessary part of an integrated pest management approach.

About SLICE and hydrogen peroxide treatments:

- Salmon farming companies use an in-feed therapeutant called SLICE (emamectin benzoate) to reduce lice abundance. In British Columbia to date, SLICE has generally been a very effective tool in the management of sea lice at salmon farms.
- The rotational use of hydrogen peroxide with SLICE on farms is a key component of Integrated Pest Management (IPM). IPM aims to control pests with minimal reliance on drugs/pesticides and prevent the development of resistance.
- Hydrogen peroxide is widely used on Canada's east and west coast, and elsewhere in the world to remove sea lice from cultured fish. This pesticide is not absorbed by the fish and is non-toxic to humans. It also dissipates as a neutralized substance quickly in the environment, causing no discernible far-field effect.

Dan Bate

Team Lead, Communications

Fisheries and Oceans Canada Pacific Region / Canadian Coast Guard / Government of Canada

Dan.Bate@dfo-mpo.gc.ca

Chef d'équipe, communications

Pêches et Océans Canada, région du Pacifique / Garde côtière canadienne / Gouvernement du Canada

Dan.Bate@dfo-mpo.gc.ca

From: [REDACTED]

Sent: October-30-18 12:34 PM

To: NCR Media RCN (DFO/MPO)

Cc: Lubczuk, Jocelyn

Subject: reaction to reports on sea lice in Clayoquot Sound

Good morning... [REDACTED] SeawestNews here

seeking DFO comments and reactions to this news report in the Vancouver Sun

<https://vancouversun.com/news/local-news/drug-resistant-sea-lice-out-of-control-on-b-c-coast-report>

which is based on this report by Living Oceans

https://livingoceans.org/sites/default/files/Lice%20report%20final_0.pdf



s.19(1)

Bate, Dan

From: [REDACTED]
Sent: October-31-18 2:27 PM
To: Bate, Dan
Cc: NCR Media RCN (DFO/MPO)
Subject: RE: Global News request for comment

Thank you.

From: Bate, Dan [mailto:Dan.Bate@dfo-mpo.gc.ca]
Sent: Wednesday, October 31, 2018 2:19 PM
To: [REDACTED]
Cc: NCR Media RCN (DFO/MPO) <Media.XNCR@dfo-mpo.gc.ca>
Subject: RE: Global News request for comment

Hi [REDACTED] understand you were seeking comment from the Department regarding a recent report from Living Oceans on sea lice resistance.

Here with some information for your story.

- Seasonal and year-to-year variations in environmental parameters (eg. ocean salinity and temperature) and the number and species composition of wild salmon returns to an area are known to influence the abundance of sea lice on farms.
- In Clayoquot sound over the winter/spring of 2017-2018, the typical drop in salinity that comes with rains did not occur. This higher salinity resulted in increased lice production in the region and exacerbated the lice levels on farms.
- Earlier this year, Fisheries and Oceans Canada (DFO) collected sea lice from Cermaq Canada's Bawden site in the Clayoquot area and sent them to the BC Centre for Aquatic Health Sciences for analysis, which confirmed SLICE resistance. Those lice were later sent to researchers at the Atlantic Veterinary College who are undertaking work to better understand the genetic basis for SLICE resistance.
- The Department also initiated a review, which is still ongoing, of Cermaq Canada's sea lice management practices in this region to determine if relevant licence conditions have been followed appropriately.
- Under the Pacific Aquaculture Regulations, DFO requires salmon farming companies to regularly monitor and manage sea lice levels at their facilities in BC. DFO also regularly conducts assessments of sea lice abundance at these facilities.
- Companies in BC must submit a lice reduction plan if monitoring shows sea lice levels higher than three motile sea lice per farmed fish during the wild salmon outmigration period from March 1 to June 30 of each year. Motile lice are those at the free-moving stages of their life cycle.
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- DFO is keeping a close eye on the issue of SLICE resistance. Research is under way, by DFO, industry, and academia, to find alternative methods to manage sea lice, and to better predict and track SLICE resistance. For instance, DFO is currently studying, or supporting research on, the use of Pacific perch as "cleaner fish" that eat sea lice off farmed fish and warm water baths to kill sea lice. More information on these projects can be found at www.dfo-mpo.gc.ca/aquaculture/sci-res/rd-eng.htm
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Thanks,
Dan

Dan Bate

Team Lead, Communications
Fisheries and Oceans Canada Pacific Region / Canadian Coast Guard / Government of Canada
Dan.Bate@dfo-mpo.gc.ca

Chef d'équipe, communications
Pêches et Océans Canada, région du Pacifique / Garde côtière canadienne / Gouvernement du Canada
Dan.Bate@dfo-mpo.gc.ca

From: [REDACTED]
Sent: October-31-18 3:16 PM
To: NCR Media RCN (DFO/MPO)
Subject: Global News request for comment

Hello,

I'm hoping the Minister can provide a comment on a story we are working on. It concerns a report from Living Oceans saying that the DFO has seen evidence showing sea lice have developed a resistance to SLICE since 2014 – but denied that the evidence existed. Furthermore, the report says that the DFO then withheld evidence from the Minister of Agriculture's Advisory Committee on Finfish Aquaculture in 2017 – 2018.

I have attached the report.

Would you be able to respond to those claims.

And as well provide what action, if any, the government is taking on this alleged issue? And if any additional research and information can be available to Global News so that we can be accurate with our story?

Thank you so much,



s.19(1)

Bate, Dan

From: Saindon, Carole
Sent: October-31-18 2:30 PM
To: Bate, Dan
Cc: Girouard, Louise
Subject: Re: Global News (BC) request for comment - Living Oceans report

Thx Dan.

Sent from my BlackBerry 10 smartphone on the Bell network.

From: Bate, Dan
Sent: Wednesday, October 31, 2018 5:15 PM
To: Saindon, Carole
Cc: Girouard, Louise
Subject: RE: Global News (BC) request for comment - Living Oceans report

Hi Carole - will do.

Dan

From: Saindon, Carole
Sent: October-31-18 2:06 PM
To: Bate, Dan
Cc: Girouard, Louise
Subject: FW: Global News (BC) request for comment - Living Oceans report

Are you good to respond to the reporter Dan?

Thx!

From: Saindon, Carole
Sent: October-31-18 4:56 PM
To: Lubczuk, Jocelyn; Stanek, Frank; Des Rosiers, Marie-Pascale
Cc: Mitchell, Laura; Young, George; O'Grady, Samantha; Knudsen, Mark; Tran, Thi; Choeurng, Stephanie; Windsor, Victoria; Kahn, Zoe; Jarjour, Jasmine; Hirani, Samia; Khwaja, Saba; Turple, Justin; Belle-Isle, Alain; Butcher, Ashley; Hubley, Marian; Quinn, Caroline; Smith, Kathleen; Fagan, Ashley; Girouard, Louise; DFO.R PAC Communications Advisors / Conseillers Communications PAC R.MPO; Chow, Vance; Mayrand, Benoit; Eatmon, Keegan; NCR Media RCN (DFO/MPO); Szerze, Anita; Seguin, Natalie; Bate, Dan
Subject: RE: Global News (BC) request for comment - Living Oceans report

Region will action shortly. Thank you.

From: Lubczuk, Jocelyn
Sent: October-31-18 4:49 PM
To: Stanek, Frank; Des Rosiers, Marie-Pascale
Cc: Mitchell, Laura; Young, George; O'Grady, Samantha; Knudsen, Mark; Tran, Thi; Choeurng, Stephanie; Windsor, Victoria; Kahn, Zoe; Jarjour, Jasmine; Hirani, Samia; Khwaja, Saba; Turple, Justin; Belle-Isle, Alain; Butcher, Ashley; Hubley, Marian; Quinn, Caroline; Smith, Kathleen; Fagan, Ashley; Girouard, Louise; DFO.R PAC Communications Advisors / Conseillers Communications PAC R.MPO; Saindon, Carole; Chow, Vance; Mayrand, Benoit; Eatmon, Keegan; NCR Media RCN (DFO/MPO); Szerze, Anita; Seguin, Natalie
Subject: RE: Global News (BC) request for comment - Living Oceans report

Hello,
Please move forward with preapproved messaging.

Thanks!

Jocelyn Lubczuk
Press Secretary
Fisheries, Oceans and the Canadian Coast Guard
Jocelyn.lubczuk@dfo-mpo.gc.ca

From: Stanek, Frank
Sent: Wednesday, October 31, 2018 3:38 PM
To: Lubczuk, Jocelyn <Jocelyn.Lubczuk@dfo-mpo.gc.ca>; Des Rosiers, Marie-Pascale <Marie-Pascale.DesRosiers@dfo-mpo.gc.ca>
Cc: Mitchell, Laura <Laura.Mitchell@dfo-mpo.gc.ca>; Young, George <George.Young@dfo-mpo.gc.ca>; O'Grady, Samantha <Samantha.O'grady@dfo-mpo.gc.ca>; Knudsen, Mark <Mark.Knudsen@dfo-mpo.gc.ca>; Tran, Thi <Thi.Tran@dfo-mpo.gc.ca>; Choeurng, Stephanie <Stephanie.Choeurng@dfo-mpo.gc.ca>; Windsor, Victoria <Victoria.Windsor@dfo-mpo.gc.ca>; Kahn, Zoe <Zoe.Kahn@dfo-mpo.gc.ca>; Jarjour, Jasmine <Jasmine.Jarjour@dfo-mpo.gc.ca>; Hirani, Samia <Samia.Hirani@dfo-mpo.gc.ca>; Khwaja, Saba <Saba.Khwaja@dfo-mpo.gc.ca>; Turple, Justin <Justin.Turple@dfo-mpo.gc.ca>; Belle-Isle, Alain <Alain.Belle-Isle@dfo-mpo.gc.ca>; Butcher, Ashley <Ashley.Butcher@dfo-mpo.gc.ca>; Hubley, Marian <Marian.Hubley@dfo-mpo.gc.ca>; Quinn, Caroline <Caroline.Quinn@dfo-mpo.gc.ca>; Smith, Kathleen <Kathleen.Smith@dfo-mpo.gc.ca>; Fagan, Ashley <Ashley.Fagan@dfo-mpo.gc.ca>; Girouard, Louise <Louise.Girouard@dfo-mpo.gc.ca>; DFO.R PAC Communications Advisors / Conseillers Communications PAC R.MPO <DFO.RPACCommunicationsAdvisors-ConseillersCommunications@dfo-mpo.gc.ca>; Saindon, Carole <Carole.Saindon@dfo-mpo.gc.ca>; Chow, Vance <Vance.Chow@dfo-mpo.gc.ca>; Mayrand, Benoit <Benoit.Mayrand@dfo-mpo.gc.ca>; Eatmon, Keegan <Keegan.Eatmon@dfo-mpo.gc.ca>; NCR Media RCN (DFO/MPO) <Media.XNCR@dfo-mpo.gc.ca>; Szerze, Anita <Anita.Szerze@dfo-mpo.gc.ca>; Seguin, Natalie <Natalie.Seguin@dfo-mpo.gc.ca>
Subject: Global News (BC) request for comment - Living Oceans report

Hi Jocelyn. Please see enclosed request. Please advise if your office would like to respond or have PAC Communications reply with previously approved messaging (below).

Regards

Frank

From: [REDACTED]
Sent: October-31-18 3:16 PM
To: NCR Media RCN (DFO/MPO)
Subject: Global News request for comment

Hello,

I'm hoping the Minister can provide a comment on a story we are working on. It concerns a report from Living Oceans saying that the DFO has seen evidence showing sea lice have developed a resistance to SLICE since 2014 – but denied that the evidence existed. Furthermore, the report says that the DFO then withheld evidence from the Minister of Agriculture's Advisory Committee on Finfish Aquaculture in 2017 – 2018.

s.16(2)(c)

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I have attached the report.

Would you be able to respond to those claims.

And as well provide what action, if any, the government is taking on this alleged issue? And if any additional research and information can be available to Global News so that we can be accurate with our story?

Thank you so much,



Issue: Living Oceans Society [redacted] released a report on sea lice and SLICE resistance in the Clayoquot today <https://livingoceans.org/action/sea-lice-out-control> Recent coverage here: <https://vancouversun.com/news/local-news/drug-resistant-sea-lice-out-of-control-on-b-c-coast-report>

Media requests from:

[redacted] Vancouver Sun (short web report),
[redacted] Vancouver Sun (longer story),
[redacted] SeaWestNews, [redacted]

Deadline: Tuesday, October 30, 4:00 p.m. PST

Approved by: Zac Waddington, Simon Jones, Allison Webb, Louise Girouard, Andy Thompson (A/RDG)

Media lines:

- Seasonal and year-to-year variations in environmental parameters (eg.ocean salinity and temperature) and the number and species composition of wild salmon returns to an area are known to influence the abundance of sea lice on farms. **Approved**
- In Clayoquot sound over the winter/spring of 2017-2018, the typical drop in salinity that comes with rains did not occur. This higher salinity resulted in increased lice production in the region and exacerbated the lice levels on farms. **New**
- Earlier this year, Fisheries and Oceans Canada (DFO) collected sea lice from Cermaq Canada's Bawden site in the Clayoquot area and sent them to the BC Centre for Aquatic Health Sciences for analysis, which confirmed SLICE resistance. Those lice were later sent to researchers at the Atlantic Veterinary College who are undertaking work to better understand the genetic basis for SLICE resistance. **Approved**
- The Department also initiated a review, which is still ongoing, of Cermaq Canada's sea lice management practices in this region to determine if relevant licence conditions have been followed appropriately. **Approved**
- Under the Pacific Aquaculture Regulations, DFO requires salmon farming companies to regularly monitor and manage sea lice levels at their facilities in BC. DFO also regularly conducts assessments of sea lice abundance at these facilities. **Approved**
- Companies in BC must submit a lice reduction plan if monitoring shows sea lice levels higher than three motile sea lice per farmed fish during the wild salmon outmigration period from March 1 to June 30 of each year. Motile lice are those at the free-moving stages of their life cycle. **Approved**
- During most years, more than 90% of sites in BC are below the regulatory thresholds for sea lice during the wild salmon outmigration period (from March 1 to June 30 of each year). However, there were documented failures of SLICE treatment at Klemtu in 2013 and Esperanza Inlet in 2017 and now Clayoquot Sound in 2018. **Approved**
- DFO is keeping a close eye on the issue of SLICE resistance. Research is under way, by DFO, industry, and academia, to find alternative methods to manage sea lice, and to better predict and track SLICE resistance. For

instance, DFO is currently studying, or supporting research on, the use of Pacific perch as "cleaner fish" that eat sea lice off farmed fish and warm water baths to kill sea lice. More information on these projects can be found at www.dfo-mpo.gc.ca/aquaculture/sci-res/rd-eng.htm **Approved**

- DFO is also supporting the licensing and approval process for alternative sea lice treatments, which are a necessary part of an integrated pest management approach. **Approved**

About SLICE and hydrogen peroxide treatments:

- Salmon farming companies use an in-feed therapeutant called SLICE (emamectin benzoate) to reduce lice abundance. In British Columbia to date, SLICE has generally been a very effective tool in the management of sea lice at salmon farms. **Approved**
- The rotational use of hydrogen peroxide with SLICE on farms is a key component of Integrated Pest Management (IPM). IPM aims to control pests with minimal reliance on drugs/pesticides and prevent the development of resistance. **New**
- Hydrogen peroxide is widely used on Canada's east and west coast, and elsewhere in the world to remove sea lice from cultured fish. This pesticide is not absorbed by the fish and is non-toxic to humans. It also dissipates as a neutralized substance quickly in the environment, causing no discernible far-field effect. **Approved**

Paylor, Adrienne

From: Paylor, Adrienne
Sent: October-31-18 3:00 PM
To: Waddington, Zac
Subject: FW: RE reaction to reports on sea lice in Clayoquot Sound

Background of what I said.....

From: Paylor, Adrienne
Sent: October-31-18 1:40 PM
To: Bate, Dan
Subject: FW: RE reaction to reports on sea lice in Clayoquot Sound

Ok I think I need some help on this....here are some bullets to review but if I call you maybe we can clean this up over the phone?

Is this statement true..

"Sea lice are "out of control" at salmon farms on the west coast of B.C. this year because they have become drug resistant"

- Sea lice abundance is monitored at all active farm sites in BC and a proportion are audited by the department of Fisheries and Oceans on a quarterly basis. All sea lice abundance data and audit results are publically reported.
- During most years, more than 90% of sites in BC are below the regulatory thresholds for sea lice during the wild salmon outmigration period (from March 1 to June 30 of each year).
- All sites culturing Atlantic Salmon in the Clayoquot region were over threshold during the 2018 outmigration period and 3 sites in the Nootka area. No facilities were over threshold in other zones.
- Abundance data from past years have indicated exceedance of the sea lice regulatory threshold in certain areas which DFO regulators have watched carefully for indication of SLICE resistance.
- All these past areas of exceedance have shown they are able to manage lice with effective treatments of SLICE in following years. From 2011-2017 approximately 90% of SLICE treatments have shown acceptable efficacy, and when reduced efficacy was observed alternative treatments such as Hydrogen Peroxide have been implemented
- Prior to 2017, more than 95% of SLICE treatments in the Clayoquot area were considered to be effective. DFO data has demonstrated that any indication of resistance has disappeared in every area where concern has been indicated through audit numbers or reported to DFO by industry in the past.
- Wild Salmon returning from the open ocean carry sea lice that have never been exposed to SLICE and **these are transferred to** farmed fish. This replenishes the genetics in the sea lice population that could develop resistance to SLICE. This allows the farm treatments to become effective again the following year.
- DFO has been working with the province of BC and industry to develop alternative tools to manage sea lice
- In cases where the use of SLICE does not result in adequate reduction of sea lice, companies can apply to the province of British Columbia for a permit to use alternative treatments,

including Paramove (a hydrogen peroxide bath). Please contact Cermaq or the Province of BC's Ministry of Environment for further information on this process.

- Hydrogen peroxide is used widely world-wide, including elsewhere on Canada's west coast, with excellent **efficacy** and no demonstrable effects to the ecosystem. This pesticide is not absorbed by the fish and is non-toxic to humans. It also dissipates as a neutralized substance (**oxygen and water**) quickly in the environment, causing no discernible far-field effect

Is this an accurate depiction..

The report claims Fisheries and Oceans Canada knew as early as 2014 that resistance was developing in sea lice, but did not take measures to ensure the protection of wild juvenile salmon from the parasite.

Measures could have included alternate treatments for sea lice ready for deployment when SLICE failed,

- This is not an accurate depiction.
- DFO has been actively monitoring and analysis sea lice data for indication of SLICE resistance since 2011 and first noticed concerns for Klemtu in 2015 and Esperanza Inlet in 2017 and now Clayoquot Sound in 2018.
- Since the monitoring numbers in Clayoquot Sound from this spring was the strongest indication of SLICE resistance to date, DFO for the first time ever took action to perform a targeted audit and collected sea lice samples from Cermaq Canada's Bawden site and sent them to the BC Centre for Aquatic Health Sciences for analysis. SLICE resistance was confirmed by the lab so those lice were later sent to Mark Fast, a researcher out of Atlantic Veterinary College who is undertaking work to better understand the genetic basis for SLICE resistance.
- DFO has taken significant action to this situation and our enforcement branch is currently investigating the management of lice at farms in Clayoquot by Cermaq Canada to determine if there has been non-compliance with the licence conditions and cannot comment further at this time..

The DFO has been contacted to comment on these claims, but the Vancouver Sun has not yet received a response. Cermaq has also been contacted. **Neither release public records of the drug treatments used on farmed salmon.**

"Eighteen years after this issue was brought to DFO's attention there is still no protection for wild salmon," said [REDACTED], one of the report's authors with Raincoast Research, and an outspoken critic of salmon farming.

From: Bate, Dan <Dan.Bate@dfo-mpo.gc.ca>

Sent: October 30, 2018 3:43 PM

To: [REDACTED]

Cc: Rainer, Michelle

Subject: RE: reaction to reports on sea lice in Clayoquot Sound

Hi [REDACTED] - Heard you were looking for info on the release of a recent report on sea lice. Sending along our key messaging on this issue.

Thanks,
Dan

s.19(1)

- Seasonal and year-to-year variations in environmental parameters (eg.ocean salinity and temperature) and the number and species composition of wild salmon returns to an area are known to influence the abundance of sea lice on farms.
- In Clayoquot sound over the winter/spring of 2017-2018, the typical drop in salinity that comes with rains did not occur. This higher salinity resulted in increased lice production in the region and exacerbated the lice levels on farms.
- Earlier this year, Fisheries and Oceans Canada (DFO) collected sea lice from Cermaq Canada's Bawden site in the Clayoquot area and sent them to the BC Centre for Aquatic Health Sciences for analysis, which confirmed SLICE resistance. Those lice were later sent to researchers at the Atlantic Veterinary College who are undertaking work to better understand the genetic basis for SLICE resistance.
- The Department also initiated a review, which is still ongoing, of Cermaq Canada's sea lice management practices in this region to determine if relevant licence conditions have been followed appropriately.
- Under the Pacific Aquaculture Regulations, DFO requires salmon farming companies to regularly monitor and manage sea lice levels at their facilities in BC. DFO also regularly conducts assessments of sea lice abundance at these facilities.
- Companies in BC must submit a lice reduction plan if monitoring shows sea lice levels higher than three motile sea lice per farmed fish during the wild salmon outmigration period from March 1 to June 30 of each year. Motile lice are those at the free-moving stages of their life cycle.
- During most years, more than 90% of sites in BC are below the regulatory thresholds for sea lice during the wild salmon outmigration period (from March 1 to June 30 of each year). However, there were documented failures of SLICE treatment at Klemtu in 2013 and Esperanza Inlet in 2017 and now Clayoquot Sound in 2018.
- DFO is keeping a close eye on the issue of SLICE resistance. Research is under way, by DFO, industry, and academia, to find alternative methods to manage sea lice, and to better predict and track SLICE resistance. For instance, DFO is currently studying, or supporting research on, the use of Pacific perch as "cleaner fish" that eat sea lice off farmed fish and warm water baths to kill sea lice. More information on these projects can be found at www.dfo-mpo.gc.ca/aquaculture/sci-res/rd-eng.htm
- DFO is also supporting the licensing and approval process for alternative sea lice treatments, which are a necessary part of an integrated pest management approach.

About SLICE and hydrogen peroxide treatments:

- Salmon farming companies use an in-feed therapeutant called SLICE (emamectin benzoate) to reduce lice abundance. In British Columbia to date, SLICE has generally been a very effective tool in the management of sea lice at salmon farms.
- The rotational use of hydrogen peroxide with SLICE on farms is a key component of Integrated Pest Management (IPM). IPM aims to control pests with minimal reliance on drugs/pesticides and prevent the development of resistance.
- Hydrogen peroxide is widely used on Canada's east and west coast, and elsewhere in the world to remove sea lice from cultured fish. This pesticide is not absorbed by the fish and is non-toxic to humans. It also dissipates as a neutralized substance quickly in the environment, causing no discernible far-field effect.

Dan Bate

Team Lead, Communications

Fisheries and Oceans Canada Pacific Region / Canadian Coast Guard / Government of Canada

Dan.Bate@dfo-mpo.gc.ca

Chef d'équipe, communications

Pêches et Océans Canada, région du Pacifique / Garde côtière canadienne / Gouvernement du Canada

Dan.Bate@dfo-mpo.gc.ca

From: [REDACTED]
Sent: October-30-18 12:34 PM
To: NCR Media RCN (DFO/MPO)
Cc: Lubczuk, Jocelyn
Subject: reaction to reports on sea lice in Clayoquot Sound

Good morning... [REDACTED] SeawestNews here

seeking DFO comments and reactions to this news report in the Vancouver SUN
<https://vancouversun.com/news/local-news/drug-resistant-sea-lice-out-of-control-on-b-c-coast-report>

which is based on this report by Living Oceans
https://livingoceans.org/sites/default/files/Lice%20report%20final_0.pdf

s.19(1)

Bate, Dan

From: Paylor, Adrienne
Sent: October-31-18 3:01 PM
To: Bate, Dan
Cc: Waddington, Zac
Subject: RE: RE reaction to reports on sea lice in Clayoquot Sound

Yes send it along to allison and now that zac is back in the office he can add to any questions she may have.
Thx

From: Bate, Dan
Sent: October-31-18 2:59 PM
To: Paylor, Adrienne
Cc: Waddington, Zac
Subject: RE: RE reaction to reports on sea lice in Clayoquot Sound

Ok thanks - are this ok to go to Allison from your perspective?

Dan

From: Paylor, Adrienne
Sent: October-31-18 2:47 PM
To: Bate, Dan
Cc: Waddington, Zac
Subject: RE: RE reaction to reports on sea lice in Clayoquot Sound

Ok thanks Dan,
The answer to how many sites in Clayoquot is not straight forward and could be a bit miss leading. Over the 4 month out migrations period there was 11 different CRMAQ farms over but not all at the same.....some just went over at the very end.

From: Bate, Dan
Sent: October-31-18 2:15 PM
To: Paylor, Adrienne
Subject: RE: RE reaction to reports on sea lice in Clayoquot Sound

Hi Adrian - my edits incorporated .. recommend we stick with the blue text below.
Would be helpful if we could detail the number of farms impacted in Clayoquot.

Dan

From: Paylor, Adrienne
Sent: October-31-18 1:40 PM
To: Bate, Dan
Subject: FW: RE reaction to reports on sea lice in Clayoquot Sound

Ok I think I need some help on this....here are some bullets to review but if I call you maybe we can clean this up over the phone?

Is this statement true..

"Sea lice are "out of control" at salmon farms on the west coast of B.C. this year because they have become drug resistant"

- Sea lice abundance is monitored at all active farm sites in BC and a portion are audited by the department of Fisheries and Oceans on a quarterly basis. All sea lice abundance data and audit results are publically reported.
- During most years, more than 90% of sites in BC are below the regulatory thresholds for sea lice during the wild salmon outmigration period (from March 1 to June 30 of each year).
- DFO has been working with the province of BC and industry to develop alternative tools to manage sea lice
- During the 2018 outmigration period, (##?) sites culturing Atlantic Salmon in the Clayoquot region and 3 sites in the Nootka area were identified with an over threshold of sea lice abundance.
- Sites experiencing sea lice exceedance have been able to manage lice with effective treatments of SLICE in. From 2011-2017 approximately 90% of SLICE treatments have shown acceptable efficacy, and when reduced efficacy was observed alternative treatments such as Hydrogen Peroxide have been implemented.
- DFO regulators have watched carefully for indication of SLICE resistance. In cases where the use of SLICE does not result in adequate reduction of sea lice, companies can apply to the province of British Columbia for a permit to use alternative treatments, including Paramove (a hydrogen peroxide bath). Please contact Cermaq or the Province of BC's Ministry of Environment for further information on this process.
- Hydrogen peroxide is used widely world-wide, including elsewhere on Canada's west coast, with excellent efficacy and no demonstrable effects to the ecosystem. This pesticide is not absorbed by the fish and is non-toxic to humans. It also dissipates as a neutralized substance (oxygen and water) quickly in the environment, causing no discernible far-field effect

- ~~• Abundance data from past years have indicated exceedance of the sea lice regulatory threshold in certain areas which DFO regulators have watched carefully for indication of SLICE resistance.~~
- ~~• Prior to 2017, more than 95% of SLICE treatments in the Clayoquot area were considered to be effective. DFO data has demonstrated that any indication of resistance has disappeared in every area where concern has been indicated through audit numbers or reported to DFO by industry in the past.~~
- ~~• Wild Salmon returning from the open ocean carry sea lice that have never been exposed to SLICE and these are transferred to farmed fish. This replenishes the genetics in the sea lice population that could develop resistance to SLICE. This allows the farm treatments to become effective again the following year.~~

Is this an accurate depiction..

The report claims Fisheries and Oceans Canada knew as early as 2014 that resistance was developing in sea lice, but did not take measures to ensure the protection of wild juvenile salmon from the parasite. Measures could have included alternate treatments for sea lice ready for deployment when SLICE failed,

- DFO has been actively monitoring and analysing sea lice data for indication of SLICE resistance since 2011 and first noted concerns at Klemtu in 2015, Esperanza Inlet in 2017, and now Clayoquot Sound in 2018.
- Since the monitoring numbers in Clayoquot Sound from this spring was the strongest indication of SLICE resistance to date, DFO took action to perform a targeted audit and collected sea lice samples from Cermaq Canada's Bawden site and sent them to the BC Centre for Aquatic Health Sciences for analysis. SLICE resistance was confirmed by the lab. Samples were later sent to the Atlantic Veterinary College which is currently undertaking work to better understand SLICE resistance.

- DFO has taken significant action and is currently investigating the management of lice at farms in Clayoquot by Cermaq Canada to determine if there has been non-compliance with the licence conditions. Due to the active investigation we cannot comment further at this time.

The DFO has been contacted to comment on these claims, but the Vancouver Sun has not yet received a response. Cermaq has also been contacted. **Neither release public records of the drug treatments used on farmed salmon.**

- In BC under DFO's Pacific Aquaculture Regulations all infested treatments are publicly reported in the sea lice abundance reports online.
- In addition, DFO publicly reports the quantity of all drugs and pesticides deposited at each aquaculture facility under the national Aquaculture Activities Regulations (AAR). This information is posted on an annual basis starting in 2016 when the regulation came into effect. The 2017 report is currently being processed for posting.

"Eighteen years after this issue was brought to DFO's attention there is still no protection for wild salmon," said [REDACTED] one of the report's authors with Raincoast Research, and an outspoken critic of salmon farming.

From: Bate, Dan <Dan.Bate@dfo-mpo.gc.ca>
Sent: October 30, 2018 3:43 PM
To: [REDACTED]
Cc: Rainer, Michelle
Subject: RE: reaction to reports on sea lice in Clayoquot Sound

Hi [REDACTED] - Heard you were looking for info on the release of a recent report on sea lice. Sending along our key messaging on this issue.

Thanks,
Dan

- Seasonal and year-to-year variations in environmental parameters (eg. ocean salinity and temperature) and the number and species composition of wild salmon returns to an area are known to influence the abundance of sea lice on farms.
- In Clayoquot sound over the winter/spring of 2017-2018, the typical drop in salinity that comes with rains did not occur. This higher salinity resulted in increased lice production in the region and exacerbated the lice levels on farms.
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Dan Bate

Team Lead, Communications

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Chef d'équipe, communications

Pêches et Océans Canada, région du Pacifique / Garde côtière canadienne / Gouvernement du Canada

Dan.Bate@dfo-mpo.gc.ca

From: [REDACTED]

Sent: October-30-18 12:34 PM

To: NCR Media RCN (DFO/MPO)

Cc: Lubczuk, Jocelyn

Subject: reaction to reports on sea lice in Clayoquot Sound

s.19(1)

Good morning... [REDACTED] SeawestNews here

seeking DFO comments and reactions to this news report in the Vancouver SUN

<https://vancouver.sun.com/news/local-news/drug-resistant-sea-lice-out-of-control-on-b-c-coast-report>

which is based on this report by Living Oceans

https://livingoceans.org/sites/default/files/Lice%20report%20final_0.pdf

s.19(1)



Bate, Dan

From: Rainer, Michelle
Sent: October-31-18 3:08 PM
To: [REDACTED]
Cc: Bate, Dan
Subject: RE: Re sea lice in wild salmon

Hi [REDACTED]

Yes, too bad you couldn't come but we may do it again in future. I am away for the next couple of days but my colleague Dan will make sure you receive a response.

Regards,
Michelle

-----Original Message-----

From: [REDACTED]
Sent: October-31-18 2:45 PM
To: Rainer, Michelle <Michelle.Rainer@dfo-mpo.gc.ca>
Subject: Re sea lice in wild salmon

Michelle: Well, now I am really regretting not having been able to go on that field trip for fish farm health audit. As you may know, [REDACTED] Living Oceans came out this week with a new report saying that sea lice have become resistant to SLICE.

As usual, with [REDACTED] research, there is no control sample here. No mention of whether sea lice numbers may have been higher in wild fish in areas that aren't in proximity to fish farms. So, I am wondering, is this something DFO keeps tabs on? If so, were there higher than average sea lice detected in wild salmon this year in areas that aren't in proximity to fish farms, or was this something exclusive to fish farms?

Is there someone at DFO I could talk to about this? Also, if there happen to be any peer reviewed scientific studies about SLICE resistance in sea lice I'd like to take a look at it. I can look for that myself, but in the event DFO is aware of any other studies that you can point me to that would be helpful.

[REDACTED]
Business in Vancouver
[REDACTED]

s.19(1)

Rainer, Michelle

From: Rainer, Michelle
Sent: October-31-18 3:21 PM
To: Bate, Dan (Dan.Bate@dfo-mpo.gc.ca)
Subject: Aquaculture ride-along for database

Hi Dan,

Here is the writeup for the database. For Star Vancouver I would just put [REDACTED]

Fish audit ride-along

Participated in a ride-along with staff from DFO's Fish Health Audit and Surveillance program. Reporters observed a fish health and sea lice audit and learned out our monitoring and auditing program. Significant attention was paid to the recent Living Oceans report on sea lice in Clayoquot Sound and our spokesperson answered a number of questions on Cermaq Canada's lice management, SLICE resistance, the effects of lice on farmed and wild salmon and what actions DFO might take in response.

Spokesperson: Zac Waddington, lead veterinarian

[REDACTED] Campbell River Mirror

office: 250-287-9227 x: [REDACTED]

cell: [REDACTED]

[REDACTED] Star Metro Vancouver

[REDACTED] CTV

[REDACTED] The Canadian Press (photos only)

s.19(1)

Rainer, Michelle

From: Waddington, Zac
Sent: October-31-18 3:35 PM
To: Rainer, Michelle
Cc: Bate, Dan
Subject: RE: Re sea lice in wild salmon
Attachments: Nekouei et al., 2018. Sea lice in Muchalat, farmed and wild..pdf; Kreitzman et al. 2018 (SLICE-resistance evolution).pdf; Lees et al., 2008. SLICE efficacy in Scotland 2002-2006.pdf; Messmer et al., 2018. SNP chip predictive of EB resistance..pdf; Saksida et al., 2010. SLICE efficacy in MHC.pdf

I have heard anecdotal reports that wild adult salmon caught in the open ocean off the west coast of Vancouver (therefore unlikely to be affected by lice in Clayoquot) had higher lice levels than in years past. One of the elements that lead to the sea lice levels in Clayoquot that we saw was the relative high salinity over the winter and spring of 2017-2018, as compared to past years. Historically, the fresh water influence as a result of winter/spring rains has been a "free lice treatment" for the farms in the area. Unfortunately that did not occur in this year.

I have attached some papers on sea lice resistance and farmed-wild interactions, you will see my highlights, but you can also find them online if so desired.

-----Original Message-----

From: Rainer, Michelle
Sent: October-31-18 3:10 PM
To: Waddington, Zac
Cc: Bate, Dan
Subject: FW: Re sea lice in wild salmon

Hi Zac,

Can you please provide a brief response to these questions? I am away for the next few days so if you could send the response to Dan that would be great.

Thanks for all your great work today! Definitely a trial by fire :).

Michelle

-----Original Message-----



From: [REDACTED]
Sent: October-31-18 2:45 PM
To: Rainer, Michelle <Michelle.Rainer@dfo-mpo.gc.ca>
Subject: Re sea lice in wild salmon

Michelle: Well, now I am really regretting not having been able to go on that field trip for fish farm health audit. As you may know, [REDACTED] Living Oceans came out this week with a new report saying that sea lice have become resistant to SLICE.

As usual, with [REDACTED] research, there is no control sample here. No mention of whether sea lice numbers may have been higher in wild fish in areas that aren't in proximity to fish farms. So, I am wondering, is this something DFO keeps tabs on? If so, were there higher than average sea lice detected in wild salmon this year in areas that aren't in proximity to fish farms, or was this something exclusive to fish farms?

s.19(1)

Is there someone at DFO I could talk to about this? Also, if there happen to be any peer reviewed scientific studies about SLICE resistance in sea lice I'd like to take a look at it. I can look for that myself, but in the event DFO is aware of any other studies that you can point me to that would be helpful.


Business in Vancouver


s.19(1)

SCIENTIFIC REPORTS

OPEN Association between sea lice (*Lepeophtheirus salmonis*) infestation on Atlantic salmon farms and wild Pacific salmon in Muchalat Inlet, Canada

Received: 24 October 2017

Accepted: 22 February 2018

Published online: 05 March 2018

Omid Nekouei¹, Raphael Vanderstichel¹, Krishna Thakur¹, Gabriel Arriagada², Thitiwan Patanasatienkul¹, Patrick Whittaker³, Barry Milligan⁴, Lance Stewardson⁵ & Crawford W. Revie¹

Growth in salmon aquaculture over the past two decades has raised concerns regarding the potential impacts of the industry on neighboring ecosystems and wild fish productivity. Despite limited evidence, sea lice have been identified as a major cause for the decline in some wild Pacific salmon populations on the west coast of Canada. We used sea lice count and management data from farmed and wild salmon, collected over 10 years (2007–2016) in the Muchalat Inlet region of Canada, to evaluate the association between sea lice recorded on salmon farms with the infestation levels on wild out-migrating Chum salmon. Our analyses indicated a significant positive association between the sea lice abundance on farms and the likelihood that wild fish would be infested. However, increased abundance of lice on farms was not significantly associated with the levels of infestation observed on the wild salmon. Our results suggest that Atlantic salmon farms may be an important source for the introduction of sea lice to wild Pacific salmon populations, but that the absence of a dose response relationship indicates that any estimate of farm impact requires more careful evaluation of causal inference than is typically seen in the extant scientific literature.

Increasing global demand for seafood and declining ocean fisheries have led to rapid growth in the aquaculture industry, including salmon farming, over the past few decades^{1–4}. Farm-based production has been successful in meeting global demands and in generating revenue⁵; however, it has often been criticized for its potential negative impacts on the ecosystem and the interaction with valuable wild species through disease transmission, interbreeding, and competition^{5–7}.

Pacific salmon (*Oncorhynchus* genera) are key species with strong cultural, socioeconomic, recreational, and symbolic significance to the residents of the Pacific Northwest^{8,9}. In recent decades, the productivity of some Pacific salmon species has been decreasing^{10–13}. Several factors are hypothesized to be associated with this decline, such as climate change, infectious diseases, anthropogenic impacts, or poor stock management, as well as the potential interplay among these factors¹⁴.

The spillover of various pathogens from non-native Atlantic salmon farms to sympatric wild fish has been a contentious issue since the onset of aquaculture in British Columbia (BC) in the 1970s. The transmission of sea lice between farmed and wild juvenile salmon along their migration routes has drawn particular attention, especially through social media, over the past years in BC^{15,16}. Sea lice (*Lepeophtheirus salmonis* and *Caligus* species) are natural ectoparasites of salmonids, with a wide distribution in marine waters of the northern hemisphere^{16,17}.

¹University of Prince Edward Island, Atlantic Veterinary College, Department of Health Management, Charlottetown, C1A 4P3, Canada. ²Interdisciplinary Center for Aquaculture Research (INCAR), University of Concepción, Concepción, 4030000, Chile. ³Grieg Seafood BC Ltd., 1180 Ironwood Street, Campbell River, BC V9W 5P7, Canada. ⁴Cermaq Canada Ltd., 919 Island Hwy #203, Campbell River, BC V9W 2C2, Canada. ⁵Mainstream Biological Consulting, 1310 Marwalk Crescent, Campbell River, BC V9W 5X1, Canada. Correspondence and requests for materials should be addressed to O.N. (email: onekouei@upe.ca)

**Pages 1398 to / à 1406
are withheld pursuant to section
sont retenues en vertu de l'article**

68(a)

**of the Access to Information Act
de la Loi sur l'accès à l'information**

**Pages 1407 to / à 1417
are duplicates of
sont des duplicatas des
pages 826 to / à 836**

Available at <https://onlinelibrary.wiley.com/doi/abs/10.1111/j.1365-2761.2010.01192.x>

Short Communication

The efficacy of emamectin benzoate against infestations of sea lice, *Lepeophtheirus salmonis*, on farmed Atlantic salmon, *Salmo salar* L., in British ColumbiaS M Saksida¹, D Morrison² and C W Revie³¹ British Columbia Centre for Aquatic Health Sciences, Campbell River, BC, Canada² Marine Harvest Canada, Campbell River, BC, Canada³ University of Prince Edward Island, Charlottetown, PEI, Canada**Keywords:** British Columbia, efficacy, emamectin benzoate, *Lepeophtheirus salmonis*, treatment.

Sea lice are a naturally occurring ectoparasite of wild salmon (Nagasawa 2001; Beamish, Neville, Sweeting & Ambers 2005). There is also clear evidence that these parasites are seldom a production or fish health concern on farms in British Columbia (Saksida, Constantine, Karreman & Donald 2007), in direct contrast to most other salmon-producing regions (Heuch, Revie & Gettinby 2003; O'Donohoe, Kane, Kelly, Nixon, Power, Naughton & Jackson 2008; Lees, Gettinby & Revie 2008a). Nevertheless, owing to concerns regarding the potential impact of sea lice originating from farmed Atlantic salmon, *Salmo salar* L., on wild Pacific salmon species, *Oncorhynchus* spp., in BC, their effective control continues to be a subject of considerable interest (Morton, Routledge, Peet & Ladwig 2004; Krkošek, Ford, Morton, Lele, Myers & Lewis 2007). Indeed, it has been suggested that the recent reductions in sea lice infestations on wild salmonids in the Broughton Archipelago (an area of major research focus over the past 5 years) are a consequence of improved lice management actions on salmon farms (Harvey 2009). While a number of management practices, such as single

year-class production and between-cycle fallowing, can have a positive effect on lice control within farms, the most direct effects are associated with the use of medicines to control sea lice. This is particularly the case if a goal is to minimize lice numbers at a specific point in the production cycle, for example during the period when wild smolts are most likely to be migrating past farms.

In 2003, BC regulatory authorities established requirements that farms maintain lice abundance below a threshold of three motile stage *Lepeophtheirus salmonis* between March and June (Saksida *et al.* 2007). In 2004, these same authorities commenced a sea lice surveillance programme where between 25% and 50% of active Atlantic salmon farms were assessed by government biologists for sea lice during each quarter to verify reported levels (Saksida *et al.* 2007). These regulations have not changed. In BC, the only product that is currently available to treat sea lice on salmon farms is SLICE® (Intervet Schering-Plough Animal Health). SLICE® is an oral formulation of emamectin benzoate, which is added to fish feed and delivered at a dosage of 0.5 µg kg⁻¹ fish for 7 days. There have been a number of reports indicating reduced efficacy of emamectin benzoate when used on farmed fish in a range of other salmon-producing countries. These include Chile (Bravo, Sevattal & Horsberg 2008) and Scotland (Lees, Baillie, Gettinby & Revie 2008b), with less well-documented reports in Ireland (O'Donohoe *et al.* 2008 – non-specific report of 'reduced sensitivities',

Correspondence S M Saksida, British Columbia Centre for Aquatic Health Sciences, PO Box 277 Island Highway, Campbell River, BC, Canada V9W 2P0
(e-mail: sonja.saksida@cahs-bc.ca)



**Pages 1419 to / à 1422
are withheld pursuant to section
sont retenues en vertu de l'article**

68(a)

**of the Access to Information Act
de la Loi sur l'accès à l'information**

Pages 1423 to / à 1424
are not relevant
sont non pertinentes

**Pages 1425 to / à 1437
are duplicates of
sont des duplicatas des
pages 1251 to / à 1263**

**Pages 1438 to / à 1450
are duplicates of
sont des duplicatas des
pages 689 to / à 701**

Bate, Dan

From: Webb, Allison
Sent: October-31-18 3:36 PM
To: Thomson, Andrew; Paylor, Adrienne; Waddington, Zac; Shaw, Kerra; Bate, Dan; Girouard, Louise
Subject: FW: Aquaculture ride-along

FYI ... may inform our responses to the recent media requests.

Allison Webb, Director / Directrice
Aquaculture Management / Gestion de l'aquaculture
Fisheries Management Branch / Direction de la gestion des pêches
Fisheries and Oceans Canada / Pêches et Océans Canada
200 - 401 Burrard St / Rue Burrard, Vancouver BC / C.B. V6C 3S4 Canada
604-666-7009
Allison.webb@dfo-mpo.gc.ca

From: Rainer, Michelle
Sent: Wednesday, October 31, 2018 3:25 PM
To: Webb, Allison <Allison.Webb@dfo-mpo.gc.ca>
Cc: McNabb, Melanie <Melanie.McNabb@dfo-mpo.gc.ca>
Subject: FW: Aquaculture ride-along

Hi Allison,
A quick summary of today for you.

Fish audit ride-along

Participated in a ride-along with staff from DFO's Fish Health Audit and Surveillance program. Reporters observed a fish health and sea lice audit and learned out our monitoring and auditing program. Significant attention was paid to the recent Living Oceans report on sea lice in Clayoquot Sound and Zac answered a number of questions on Cermaq Canada's lice management, SLICE resistance, the effects of lice on farmed and wild salmon and what actions DFO might take in response. Kerra did a great interview on our management in general, why we invited media to the audit, the data we make available to the public and our wish to increase public knowledge and trust in our regulation.

Spokespersons: Zac Waddington, Kerra Shaw

[REDACTED] Campbell River Mirror

office: 250-287-9227 x [REDACTED]
cell: [REDACTED]

[REDACTED] Star Metro Vancouver

cell: [REDACTED]

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[REDACTED] CTV

c [REDACTED]

[REDACTED]
Cell: [REDACTED]

[REDACTED] The Canadian Press (photos only)
[REDACTED]

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Bate, Dan

From: Bate, Dan
Sent: October-31-18 3:55 PM
To: [REDACTED]
Cc: Rainer, Michelle
Subject: RE: Re sea lice in wild salmon

Hi [REDACTED] a little more information for your story.

Thanks,
Dan

- Seasonal and year-to-year variations in environmental parameters (eg.ocean salinity and temperature) and the number and species composition of wild salmon returns to an area are known to influence the abundance of sea lice on farms.
- In Clayoquot sound over the winter/spring of 2017-2018, the typical drop in salinity that comes with rains did not occur. This higher salinity resulted in increased lice production in the region and exacerbated the lice levels on farms.
- Earlier this year, Fisheries and Oceans Canada (DFO) collected sea lice from Cermaq Canada's Bawden site in the Clayoquot area and sent them to the BC Centre for Aquatic Health Sciences for analysis, which confirmed SLICE resistance. Those lice were later sent to researchers at the Atlantic Veterinary College who are undertaking work to better understand the genetic basis for SLICE resistance.
- The Department also initiated a review, which is still ongoing, of Cermaq Canada's sea lice management practices in this region to determine if relevant licence conditions have been followed appropriately.
- Under the Pacific Aquaculture Regulations, DFO requires salmon farming companies to regularly monitor and manage sea lice levels at their facilities in BC. DFO also regularly conducts assessments of sea lice abundance at these facilities.
- Companies in BC must submit a lice reduction plan if monitoring shows sea lice levels higher than three motile sea lice per farmed fish during the wild salmon outmigration period from March 1 to June 30 of each year. Motile lice are those at the free-moving stages of their life cycle.
- During most years, more than 90% of sites in BC are below the regulatory thresholds for sea lice during the wild salmon outmigration period (from March 1 to June 30 of each year). However, there were documented failures of SLICE treatment at Klemtu in 2013 and Esperanza Inlet in 2017 and now Clayoquot Sound in 2018.
- DFO is keeping a close eye on the issue of SLICE resistance. Research is under way, by DFO, industry, and academia, to find alternative methods to manage sea lice, and to better predict and track SLICE resistance. For instance, DFO is currently studying, or supporting research on, the use of Pacific perch as "cleaner fish" that eat sea lice off farmed fish and warm water baths to kill sea lice. More information on these projects can be found at www.dfo-mpo.gc.ca/aquaculture/sci-res/rd-eng.htm
- DFO is also supporting the licensing and approval process for alternative sea lice treatments, which are a necessary part of an integrated pest management approach.

About SLICE and hydrogen peroxide treatments:

- Salmon farming companies use an in-feed therapeutant called SLICE (emamectin benzoate) to reduce lice abundance. In British Columbia to date, SLICE has generally been a very effective tool in the management of sea lice at salmon farms.

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- The rotational use of hydrogen peroxide with SLICE on farms is a key component of Integrated Pest Management (IPM). IPM aims to control pests with minimal reliance on drugs/pesticides and prevent the development of resistance.
- Hydrogen peroxide is widely used on Canada's east and west coast, and elsewhere in the world to remove sea lice from cultured fish. This pesticide is not absorbed by the fish and is non-toxic to humans. It also dissipates as a neutralized substance quickly in the environment, causing no discernible far-field effect.

Dan Bate

Team Lead, Communications
Fisheries and Oceans Canada Pacific Region / Canadian Coast Guard / Government of Canada
Dan.Bate@dfo-mpo.gc.ca

Chef d'équipe, communications
Pêches et Océans Canada, région du Pacifique / Garde côtière canadienne / Gouvernement du Canada
Dan.Bate@dfo-mpo.gc.ca

-----Original Message-----

From: Rainer, Michelle
Sent: October-31-18 3:42 PM
To: [REDACTED]
Cc: Bate, Dan
Subject: FW: Re sea lice in wild salmon

s.19(1)

Hi [REDACTED]
Dan will get back to you on the other question but in the meantime here are some papers you might find useful.
Regards,
Michelle

-----Original Message-----

From: [REDACTED]
Sent: October-31-18 2:45 PM
To: Rainer, Michelle <Michelle.Rainer@dfo-mpo.gc.ca>
Subject: Re sea lice in wild salmon

Michelle: Well, now I am really regretting not having been able to go on that field trip for fish farm health audit. As you may know, [REDACTED] Living Oceans came out this week with a new report saying that sea lice have become resistant to SLICE.

As usual, with [REDACTED] research, there is no control sample here. No mention of whether sea lice numbers may have been higher in wild fish in areas that aren't in proximity to fish farms. So, I am wondering, is this something DFO keeps tabs on? If so, were there higher than average sea lice detected in wild salmon this year in areas that aren't in proximity to fish farms, or was this something exclusive to fish farms?

Is there someone at DFO I could talk to about this? Also, if there happen to be any peer reviewed scientific studies about SLICE resistance in sea lice I'd like to take a look at it. I can look for that myself, but in the event DFO is aware of any other studies that you can point me to that would be helpful.

Business in Vancouver

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No further information has been removed or severed from this page

Bate, Dan

From: Rainer, Michelle
Sent: October-31-18 3:42 PM
To: [REDACTED]
Cc: Bate, Dan
Subject: FW: Re sea lice in wild salmon
Attachments: Nekouei et al., 2018. Sea lice in Muchalat, farmed and wild..pdf; Kreitzman et al. 2018 (SLICE-resistance evolution).pdf; Lees et al., 2008. SLICE efficacy in Scotland 2002-2006.pdf; Messmer et al., 2018. SNP chip predictive of EB resistance..pdf; Saksida et al., 2010. SLICE efficacy in MHC.pdf

Hi [REDACTED]
Dan will get back to you on the other question but in the meantime here are some papers you might find useful.
Regards,
Michelle

-----Original Message-----

From: [REDACTED]
Sent: October-31-18 2:45 PM
To: Rainer, Michelle <Michelle.Rainer@dfo-mpo.gc.ca>
Subject: Re sea lice in wild salmon

Michelle: Well, now I am really regretting not having been able to go on that field trip for fish farm health audit. As you may know, [REDACTED] Living Oceans came out this week with a new report saying that sea lice have become resistant to SLICE.

As usual, with [REDACTED] research, there is no control sample here. No mention of whether sea lice numbers may have been higher in wild fish in areas that aren't in proximity to fish farms. So, I am wondering, is this something DFO keeps tabs on? If so, were there higher than average sea lice detected in wild salmon this year in areas that aren't in proximity to fish farms, or was this something exclusive to fish farms?

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[REDACTED]
Business in Vancouver
[REDACTED]

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**Pages 1457 to / à 1469
are duplicates of
sont des duplicatas des
pages 689 to / à 701**

**Pages 1470 to / à 1479
are duplicates of
sont des duplicatas des
pages 1397 to / à 1406**

**Pages 1480 to / à 1492
are duplicates of
sont des duplicatas des
pages 1251 to / à 1263**

**Pages 1493 to / à 1497
are duplicates of
sont des duplicatas des
pages 1418 to / à 1422**

**Pages 1498 to / à 1508
are duplicates of
sont des duplicatas des
pages 826 to / à 836**

Waddington, Zac

From: Waddington, Zac
Sent: October-31-18 4:07 PM
To: Webb, Allison, Paylor, Adrienne
Subject: FW: Media inquiry on sea lice report

Here's some bullets that Michelle, Simon Jones and I worked on yesterday. For a start

Zac

From: Waddington, Zac
Sent: October-30-18 12:43 PM
To: Rainer, Michelle; Jones, Simon
Subject: RE: Media inquiry on sea lice report

Please see my edits below in red. Simon and I had a chat and the comments below reflect what we were thinking,

Zac

From: Rainer, Michelle
Sent: October-30-18 11:49 AM
To: Jones, Simon; Waddington, Zac
Subject: FW: Media inquiry on sea lice report

Hi Zac and Simon. Here is a clean version of the draft so far.
Thanks,
Michelle

Issue: Living Oceans Society [REDACTED] released a report on sea lice and SLICE resistance in the Clayoquot today <https://livingoceans.org/action/sea-lice-out-control>.

Media requests from:

[REDACTED] Vancouver Sun (short web report),
[REDACTED] Vancouver Sun (longer story),
[REDACTED] SeaWestNews, [REDACTED]

Deadline: Tuesday, October 31, 4:00 p.m. PST

Media lines:

- Seasonal and year-to-year variations in environmental parameters (eg.ocean salinity and temperature) and the number and species composition of wild salmon returns to an area are known to influence the abundance of sea lice on farms. **Approved**
- In Clayoquot sound over the winter/spring of 2017-2018, the typical drop in salinity that comes with rains did not occur. This higher salinity resulted in increased lice production in the region and exacerbated the lice levels on farms. **New**
- Earlier this year, Fisheries and Oceans Canada (DFO) collected sea lice from Cermaq Canada's Bawden site in the Clayoquot area and sent them to the BC Centre for Aquatic Health Sciences for analysis, which

confirmed SLICE resistance. Those lice were later sent to researchers at the Atlantic Veterinary College who are undertaking work to better understand the genetic basis for SLICE resistance. **Approved**

- The Department also initiated a review, which is still ongoing, of Cermaq Canada's sea lice management practices in this region to determine if relevant licence conditions have been followed appropriately. **Approved**
- During most years, more than 90% of sites in BC are below the regulatory thresholds for sea lice during the wild salmon outmigration period (from March 1 to June 30 of each year). However, there were documented failures of SLICE treatment at Klemtu in 2013 and Esperanza Inlet in 2017 and now Clayoquot Sound in 2018. **Approved**
- DFO is keeping a close eye on the issue of SLICE resistance. Research is under way, by DFO, industry, and academia, to find alternative methods to manage sea lice, and to better predict and track SLICE resistance. For instance, DFO is currently studying, or supporting research on, the use of Pacific perch as "cleaner fish" that eat sea lice off farmed fish and warm water baths to kill sea lice. More information on these projects can be found at www.dfo-mpo.gc.ca/aquaculture/sci-res/rd-eng.htm **approved**
- DFO is also supporting the licensing and approval process for alternative sea lice treatments, which are a necessary part of an integrated pest management approach. **Approved**

About SLICE and hydrogen peroxide treatments:

- Salmon farming companies use an in-feed therapeutant called SLICE (emamectin benzoate) to reduce lice abundance. In British Columbia to date, SLICE has generally been a very effective tool in the management of sea lice at salmon farms. **Approved**
- The rotational use of hydrogen peroxide with SLICE on farms is a key component of Integrated Pest Management (IPM). IPM aims to control pests with minimal reliance on drugs/pesticides and prevent the development of resistance. **New**
- Hydrogen peroxide is widely used on Canada's east and west coast, and elsewhere in the world to remove sea lice from cultured fish. This pesticide is not absorbed by the fish and is non-toxic to humans. It also dissipates as a neutralized substance quickly in the environment, causing no discernible far-field effect. **Approved**

Bate, Dan

From: Bate, Dan
Sent: October-31-18 4:09 PM
To: [REDACTED]
Cc: Rainer, Michelle
Subject: RE: RE reaction to reports on sea lice in Clayoquot Sound

Hi [REDACTED] we are looking into some responses to these questions.
Be back when we have some materials ready to go.

Dan

From: [REDACTED]
Sent: October-31-18 4:36 AM
To: Bate, Dan
Cc: Rainer, Michelle
Subject: RE reaction to reports on sea lice in Clayoquot Sound

Good morning and thank you for the response.. As I work to put together a piece, could you also provide your comments on these issues raised in the report..

Is this statement true..

"Sea lice are "out of control" at salmon farms on the west coast of B.C. this year because they have become drug resistant"

Is this an accurate depiction..

The report claims Fisheries and Oceans Canada knew as early as 2014 that resistance was developing in sea lice, but did not take measures to ensure the protection of wild juvenile salmon from the parasite. Measures could have included alternate treatments for sea lice ready for deployment when SLICE failed,

The DFO has been contacted to comment on these claims, but the Vancouver Sun has not yet received a response. Cermaq has also been contacted. **Neither release public records of the drug treatments used on farmed salmon.**

"Eighteen years after this issue was brought to DFO's attention there is still no protection for wild salmon," said [REDACTED] one of the report's authors with Raincoast Research, and an outspoken critic of salmon farming.

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From: Bate, Dan <Dan.Bate@dfo-mpo.gc.ca>
Sent: October 30, 2018 3:43 PM
To: [REDACTED]
Cc: Rainer, Michelle
Subject: RE: reaction to reports on sea lice in Clayoquot Sound

Hi [REDACTED] Heard you were looking for info on the release of a recent report on sea lice.
Sending along our key messaging on this issue.

Thanks,
Dan

- Seasonal and year-to-year variations in environmental parameters (eg. ocean salinity and temperature) and the number and species composition of wild salmon returns to an area are known to influence the abundance of sea lice on farms.
- In Clayoquot sound over the winter/spring of 2017-2018, the typical drop in salinity that comes with rains did not occur. This higher salinity resulted in increased lice production in the region and exacerbated the lice levels on farms.
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- Under the Pacific Aquaculture Regulations, DFO requires salmon farming companies to regularly monitor and manage sea lice levels at their facilities in BC. DFO also regularly conducts assessments of sea lice abundance at these facilities.
- Companies in BC must submit a lice reduction plan if monitoring shows sea lice levels higher than three motile sea lice per farmed fish during the wild salmon outmigration period from March 1 to June 30 of each year. Motile lice are those at the free-moving stages of their life cycle.
- During most years, more than 90% of sites in BC are below the regulatory thresholds for sea lice during the wild salmon outmigration period (from March 1 to June 30 of each year). However, there were documented failures of SLICE treatment at Klemtu in 2013 and Esperanza Inlet in 2017 and now Clayoquot Sound in 2018.
- DFO is keeping a close eye on the issue of SLICE resistance. Research is under way, by DFO, industry, and academia, to find alternative methods to manage sea lice, and to better predict and track SLICE resistance. For instance, DFO is currently studying, or supporting research on, the use of Pacific perch as "cleaner fish" that eat sea lice off farmed fish and warm water baths to kill sea lice. More information on these projects can be found at www.dfo-mpo.gc.ca/aquaculture/sci-res/rd-eng.htm
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Dan Bate

Team Lead, Communications
Fisheries and Oceans Canada Pacific Region / Canadian Coast Guard / Government of Canada
Dan.Bate@dfo-mpo.gc.ca

Chef d'équipe, communications
Pêches et Océans Canada, région du Pacifique / Garde côtière canadienne / Gouvernement du Canada
Dan.Bate@dfo-mpo.gc.ca

From: [REDACTED]
Sent: October-30-18 12:34 PM
To: NCR Media RCN (DFO/MPO)
Cc: Lubczuk, Jocelyn
Subject: reaction to reports on sea lice in Clayoquot Sound

Good morning.. [REDACTED] SeawestNews here

seeking DFO comments and reactions to this news report in the Vancouver SUN
<https://vancouversun.com/news/local-news/drug-resistant-sea-lice-out-of-control-on-b-c-coast-report>

which is based on this report by Living Oceans
https://livingoceans.org/sites/default/files/Lice%20report%20final_0.pdf

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Waddington, Zac

From: Paylor, Adrienne
Sent: October-31-18 4:26 PM
To: Waddington, Zac
Subject: FW: RE reaction to reports on sea lice in Clayoquot Sound

Here is the email chain with the lines approved yesterday going out to media and the questions that came back. Red wording is mine and blue is what Krista added. Short and simple is better so whatever you can do to hit the key issues.

From: Sandberg, Krista
Sent: October-31-18 12:37 PM
To: Paylor, Adrienne
Subject: RE: RE reaction to reports on sea lice in Clayoquot Sound

My comments in blue

Krista Sandberg

Office | Bureau 250-286-5835
Cellular | Cellulaire [REDACTED]



Government
of Canada

Gouvernement
du Canada

Canada

From: Paylor, Adrienne
Sent: October-31-18 11:39 AM
To: Sandberg, Krista
Subject: FW: RE reaction to reports on sea lice in Clayoquot Sound

Ok some bullets to review.....

Is this statement true..

"Sea lice are "out of control" at salmon farms on the west coast of B.C. this year because they have become drug resistant"

- Sea lice abundance is monitored at all active farm sites in BC and a proportion are ~~monitored and~~ audited by the department of Fisheries and Oceans on a quarterly basis. All sea lice abundance data and audit results are ~~and~~ publically reported.
- ~~As shown on DFO open data web site only one? other farm on the west of BC was over the three motile sea lice threshold during the 2018 out migration period. All sites culturing Atlantic Salmon in the Clayoquot region were over threshold during the 2018 outmigration period and 3 sites in the Nootka area. No facilities were over threshold in other zones.~~
- ~~Audit number~~ Abundance data from past years have indicated exceedance of the sea lice regulatory threshold in certain areas which DFO regulators have watched carefully for indication of SLICE resistance.
- All these past areas of exceedance have shown they are able to manage lice with effective treatments of SLICE in following years. From 2011-2017 approximately 90% of SLICE treatments have shown acceptable efficacy, and when reduced efficacy was observed alternative treatments such as Hydrogen Peroxide have been implemented

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- Prior to 2017, more than 95% of SLICE treatments in the Clayoquot area were considered to be effective.
- Wild Salmon returning from the open ocean carry sea lice that have never been exposed to SLICE and deposit them on farmed fish. This replenishes ~~and removes~~ the genetics in the sea lice population that ~~are~~ could developing resistance to SLICE. This allows the farm treatments to become effective again the following year.

Is this an accurate depiction..

The report claims Fisheries and Oceans Canada knew as early as 2014 that resistance was developing in sea lice, but did not take measures to ensure the protection of wild juvenile salmon from the parasite.

Measures could have included alternate treatments for sea lice ready for deployment when SLICE failed,

The DFO has been contacted to comment on these claims, but the Vancouver Sun has not yet received a response. Cermaq has also been contacted. **Neither release public records of the drug treatments used on farmed salmon.**

"Eighteen years after this issue was brought to DFO's attention there is still no protection for wild salmon," said [REDACTED] one of the report's authors with Raincoast Research, and an outspoken critic of salmon farming.

From: Bate, Dan <Dan.Bate@dfo-mpo.gc.ca>

Sent: October 30, 2018 3:43 PM

To: [REDACTED]

Cc: Rainer, Michelle

Subject: RE: reaction to reports on sea lice in Clayoquot Sound

Hi [REDACTED] Heard you were looking for info on the release of a recent report on sea lice. Sending along our key messaging on this issue.

Thanks,
Dan

- Seasonal and year-to-year variations in environmental parameters (eg.ocean salinity and temperature) and the number and species composition of wild salmon returns to an area are known to influence the abundance of sea lice on farms.
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- The Department also initiated a review, which is still ongoing, of Cermaq Canada's sea lice management practices in this region to determine if relevant licence conditions have been followed appropriately.

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- Companies in BC must submit a lice reduction plan if monitoring shows sea lice levels higher than three motile sea lice per farmed fish during the wild salmon outmigration period from March 1 to June 30 of each year. Motile lice are those at the free-moving stages of their life cycle.
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Dan Bate

Team Lead, Communications
Fisheries and Oceans Canada Pacific Region / Canadian Coast Guard / Government of Canada
Dan.Bate@dfo-mpo.gc.ca

Chef d'équipe, communications
Pêches et Océans Canada, région du Pacifique / Garde côtière canadienne / Gouvernement du Canada
Dan.Bate@dfo-mpo.gc.ca

From: [REDACTED]
Sent: October-30-18 12:34 PM
To: NCR Media RCN (DFO/MPO)
Cc: Lubczuk, Jocelyn
Subject: reaction to reports on sea lice in Clayoquot Sound

Good morning.. [REDACTED] SeawestNews here

seeking DFO comments and reactions to this news report in the Vancouver SUN
<https://vancouversun.com/news/local-news/drug-resistant-sea-lice-out-of-control-on-b-c-coast-report>

which is based on this report by Living Oceans

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https://livingoceans.org/sites/default/files/Lice%20report%20final_0.pdf



s.19(1)

Bate, Dan

From: Girouard, Louise
Sent: October-31-18 4:36 PM
To: Seguin, Natalie
Cc: Szerze, Anita; Bate, Dan; Rainer, Michelle
Subject: RE: Fish audit?

Hi Nat,

FYI Here is a quick update from the proactive with media today that Michelle Rainer was leading.

L

Fish audit ride-along

Participated in a ride-along with staff from DFO's Fish Health Audit and Surveillance program. Reporters observed a fish health and sea lice audit and learned out our monitoring and auditing program.

Significant attention was paid to the recent Living Oceans report on sea lice in Clayoquot Sound and Zac answered a number of questions on Cermaq Canada's lice management; SLICE resistance, the effects of lice on farmed and wild salmon and what actions DFO might take in response.

Kerra did a great interview on our management in general, why we invited media to the audit, the data we make available to the public and our wish to increase public knowledge and trust in our regulation.

Spokespersons: Zac Waddington, Kerra Shaw

[REDACTED] Campbell River Mirror

[REDACTED]
office: 250-287-9227 x [REDACTED]
cell: [REDACTED]

[REDACTED], Star Metro Vancouver

cell: [REDACTED]

[REDACTED] CTV

c [REDACTED]

s.19(1)

Cell: [REDACTED]

[REDACTED] The Canadian Press (photos only)

From: Seguin, Natalie
Sent: Tuesday, October 30, 2018 9:18 AM
To: Girouard, Louise <Louise.Girouard@dfo-mpo.gc.ca>
Cc: Szerze, Anita <Anita.Szerze@dfo-mpo.gc.ca>; Bate, Dan <Dan.Bate@dfo-mpo.gc.ca>
Subject: RE: Fish audit?

That's it! Thanks!



~N

Natalie Séguin
Fisheries and Oceans Canada | Pêches et Océans Canada
Natalie.Seguin@dfo-mpo.gc.ca | **NEW/NOUVEAU** 613-990-1867

From: Girouard, Louise
Sent: October-30-18 12:16 PM
To: Seguin, Natalie
Cc: Szerze, Anita; Bate, Dan
Subject: RE: Fish audit?

Nat,
I think you might be referring to the Fish Health Audit tour that Michelle Rainer is doing at Campbell River aquaculture facility with media tomorrow – pro-active. See attached email for details.

Would that be it?

L

From: Seguin, Natalie
Sent: Tuesday, October 30, 2018 8:45 AM
To: Girouard, Louise <Louise.Girouard@dfo-mpo.gc.ca>
Cc: Szerze, Anita <Anita.Szerze@dfo-mpo.gc.ca>
Subject: Fish audit?

Hi Louise,

At pre-look on Friday, I believe Dan mentioned something about a fish health audit – apparently I didn't take great notes and now I can't remember the details. Does this sound familiar and can we get some background?

Thanks!

~N

Natalie Séguin
A/Manager | Communications Branch
Fisheries and Oceans Canada | Government of Canada
Natalie.Seguin@dfo-mpo.gc.ca | **NEW:** Telephone: 613-990-1867

Gestionnaire intérimaire | Direction générale des communications
Pêches et Océans Canada | Gouvernement du Canada
Natalie.Seguin@dfo-mpo.gc.ca | **NOUVEAU** : Téléphone : 613-990-1867

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No information has been removed or severed from this page

Delaney, Paula

From: Webb, Allison
Sent: November-01-18 8:11 AM
To: Waddington, Zac
Subject: Fw: Sea Lice
Attachments: Pac-MINO Briefing Agenda.docx

Just in - we'll be up second so you can dial in 5 min after it starts or @ the beginning. I'll head up for 830ish

Sent from my BlackBerry 10 smartphone on the Bell network.

From: Kaba, Kyle <Kyle.Kaba@dfo-mpo.gc.ca>
Sent: Thursday, November 1, 2018 8:09 AM
To: Houston, Kim; Webb, Allison
Cc: Lowe, Carmel
Subject: RE: Sea Lice

Sounds good, thanks Kim. Attached is the agenda for the call today.

Kyle Kaba
Team Leader, Regional Director General's Office
Fisheries and Oceans Canada/Government of Canada
Tel: 604-666-7102 Fax: 604-666-8956

From: Houston, Kim
Sent: November-01-18 8:00 AM
To: Webb, Allison; Kaba, Kyle
Cc: Lowe, Carmel
Subject: RE: Sea Lice

Good Morning
Simon Jones will be joining me on this call as well (I hope) as a SME.
Thanks. Talk soon.
Kim

From: Webb, Allison
Sent: 2018-October-31 12:36 PM
To: Kaba, Kyle; Houston, Kim
Cc: Lowe, Carmel
Subject: RE: Sea Lice

Hi Kyle – I will be able to attend and may also wish to have our vet on the line to answer any detailed technical questions. Tx.

Allison Webb, Director / Directrice
Aquaculture Management / Gestion de l'aquaculture

Fisheries Management Branch / Direction de la gestion des pêches

Fisheries and Oceans Canada / Pêches et Océans Canada

200 - 401 Burrard St / Rue Burrard, Vancouver BC / C.B. V6C 3S4 Canada

604-666-7009

Allison.webb@dfo-mpo.gc.ca

From: Kaba, Kyle

Sent: Wednesday, October 31, 2018 11:47 AM

To: Houston, Kim <Kim.Houston@dfo-mpo.gc.ca>; Webb, Allison <Allison.Webb@dfo-mpo.gc.ca>

Cc: Lowe, Carmel <Carmel.Lowe@dfo-mpo.gc.ca>

Subject: RE: Sea Lice

Perfect, thanks Kim. Much appreciated. I will share the invite with you shortly. Agenda will follow.

Kyle Kaba

Team Leader, Regional Director General's Office

Fisheries and Oceans Canada/Government of Canada

Tel: 604-666-7102 Fax: 604-666-8956

From: Houston, Kim

Sent: October-31-18 11:40 AM

To: Kaba, Kyle; Webb, Allison

Cc: Lowe, Carmel

Subject: RE: Sea Lice

Hi Kyle

I am available at that time. In the meantime I will reach out to some of our folks and see if I can get an update on things. Please keep me posted.

Kim

From: Kaba, Kyle

Sent: 2018–October-31 11:23 AM

To: Houston, Kim; Webb, Allison

Cc: Lowe, Carmel

Subject: FW: Sea Lice

Hi Kim/Allison,

A month ago we were contacted by the Minister's Office with the article linked below. At that time, I reached out to Carmel and Andy for a response. From what I recall, Simon Jones developed the bullets below. [REDACTED]

I've checked with Andy and he suggested to loop-in Science and Aquaculture.

We have a Pac/MINO call scheduled for tomorrow morning 8:30-9:30am PST. Can you please advise if you are able to attend?

Thanks in advance.

Kyle Kaba

Team Leader, Regional Director General's Office

Fisheries and Oceans Canada/Government of Canada

s.21(1)(a)

s.21(1)(b)

Tel: 604-666-7102 Fax: 604-666-8956

From: Butcher, Ashley
Sent: October-31-18 10:07 AM
To: Kaba, Kyle
Cc: Barker, Tyler; Hirani, Samia; Jarjour, Jasmine; Kahn, Zoe; Robinson, Connor
Subject: FW: Sea Lice

FYI!

From: Knudsen, Mark
Sent: Wednesday, October 31, 2018 12:15 PM
To: Butcher, Ashley <Ashley.Butcher@dfo-mpo.gc.ca>
Subject: RE: Sea Lice

Can we add this to the next Pac call for a more in-depth discussion tomorrow?

From: Butcher, Ashley
Sent: Wednesday, October 31, 2018 12:12 PM
To: Knudsen, Mark <Mark.Knudsen@dfo-mpo.gc.ca>
Subject: FW: Sea Lice

From: Butcher, Ashley
Sent: Friday, September 28, 2018 6:20 PM
To: Knudsen, Mark <Mark.Knudsen@dfo-mpo.gc.ca>; Des Rosiers, Marie-Pascale <Marie-Pascale.DesRosiers@dfo-mpo.gc.ca>; Tran, Thi <Thi.Tran@dfo-mpo.gc.ca>; Lubczuk, Jocelyn <Jocelyn.Lubczuk@dfo-mpo.gc.ca>
Subject: FW: Sea Lice

For the life of me I cannot find the email of who sent this request, so spamming the lot of you ☺ it was in response to this article:

<https://hashilthsa.com/news/2018-09-17/high-sea-lice-counts-leads-cermaq-close-farm-site-clayoquot-sound>

Sea Lice:

- DFO's sea lice regulations currently focus on the salmon louse, *Lepeophtherius salmonis*, and include a management threshold of 3 lice per fish
- Prior to closure of the site there was an infestation with another sea lice species, "Caligus".
- The Caligus infestation was sufficiently severe to cause a fish welfare concern and trigger a SLICE treatment.
- Although the SLICE treatment was successful, the farm was closed [REDACTED]
- Persistent, high levels of Caligus are rare on farmed fish; as are welfare concerns caused by this parasite.
- Caligus is a common parasite of herring and stickleback in coastal BC.

s.20(1)(b)

Here are DFO's most recent approved media lines relating to sea lice/salmon farming in Clayoquot.

Media lines:

- Fisheries and Oceans Canada (DFO) is confident in the monitoring being done in the Clayoquot area by environmental non-government groups, and third party environmental consultants hired by Cermaq. For this reason,


DFO determined that resources could be better directed to furthering research into SLICE resistance (SLICE is approved for use in Canada as an in-feed therapeutant used by the salmon aquaculture industry to manage sea lice. It can only be administered to farmed fish under veterinary prescription).

- DFO is keeping a close eye on the issue of SLICE resistance. The Department collected sea lice from Cermaq Canada's Bawden site in the Clayoquot area and sent them to the BC Centre for Aquatic Health Sciences for analysis, which confirmed SLICE resistance. Those lice were later sent to researchers at the Atlantic Veterinary College who are undertaking work to better understand the genetic basis for SLICE resistance.
- During most years, more than 90% of sites in BC are below the regulatory thresholds for sea lice during the wild salmon outmigration period (from March 1 to June 30 of each year). However, there were documented failures of SLICE treatment at Klemtu in 2015 and Esperanza Inlet in 2017 and now Clayoquot Sound in 2018.
- Research is under way, by DFO, industry, and academia, to find alternative methods to manage sea lice, and to better predict and track SLICE resistance. For instance, DFO is currently studying, or supporting research on, the use of Pacific perch as "cleaner fish" that eat sea lice off farmed fish and warm water baths to kill sea lice. More information on these projects can be found at www.dfo-mpo.gc.ca/aquaculture/sci-res/rd-eng.htm
- DFO is also supporting the licensing and approval process for alternative sea lice treatments, which are a necessary part of an integrated pest management approach.

Ashley

Weekly Pacific Region / Minister's Office Briefing

Thursday November 1, 2018
8:30am-9:30am PST / 11:30am-12:30pm EST

Dial in Number: 1 877 413 4790 Conference ID: 

Agenda:

1. Roll Call: Minister's Office; Deputy Minister's Office; Pacific Region

Lead: Kyle Kaba, Team Leader Executive Secretariat

2. De-brief from in-person Steelhead consultation meetings: Williams Lake (Oct. 23) and Kelowna (Oct. 30)

Leads: Andrew Thomson, Regional Director Fisheries Management Branch; Jennifer Nener, Director of Salmon Management and Client Services

3. Sea Lice: Further discussion to informal inquiry (attached)

Leads: Kim Houston, A/ Regional Director Science; Allison Webb, Director Aquaculture Management



RE URGENT
INFORMAL Sea Lice .

Standing Items:

4. Salmon Updates

Leads: Jennifer Nener, Director of Salmon Management and Client Services; Jeff Grout, Resource Manager, Salmon, Fisheries and Aquaculture Management

5. Communications Updates

Lead: Louise Girouard, Regional Director Communications

s.19(1)

REVIEW

Living Oceans: Lousy Choices – Drug-resistant Sea Lice in Clayoquot Sound

Executive summary

- *“Report gives evidence that the parasite has become resistant to SLICE; and that regulators and industry knew resistance was developing as early as 2014, but have publicly and repeatedly denied the fact”*
 - Industry has been aware of resistance developing in various regions since 2013
 - Regulators have also been aware of this issue. Given the data available to use we have been monitoring the issue and repeatedly in most regions, after a period of fallowing, the efficacy of SLICE is renewed following the influx of naïve sea lice from in-migrating wild salmonids
 - Based on the data provided by industry there has been no instance of continued SLICE resistance following usual industry measures
 - There is no evidence that DFO has repeatedly denied the presence of resistance in BC
- *“Despite the approval of alternate treatments that might have been effective (.....) industry failed to have alternate treatments available in time to prevent lethal levels of infestation”; “1-3 sea lice can be lethal to a juvenile salmon”*
 - DFO has supported the development and licencing of new lice treatment modalities at every opportunity
 - Some examples include: the licencing for hydrogen peroxide use in BC, research into cleaner fish, development of models to support area-based management, research into risk factors for SLICE resistance, the licencing Imvixa (an in-feed drug used in hatchery to confer up to 9 months protection from sea louse infestation), funding for implementation of various green technologies on farm (FACTAP).
 - Since 2014, companies have made significant investments in mechanical removal technologies (hydrolicer), hosted workshops on Integrated Pest Management techniques, purchased and ordered well boats to facilitate peroxide and fresh water bath treatments, gained pesticide use
 - Accurate assessment of species-specific lethal levels of infestation is currently not agreed upon.
 - Implying that there were levels of lice infestation which would “ensure death,” is presumptive
 - Jones et al., 2009 found that a lethal lice level on juvenile pink salmon to be 7.5/g and only so when pink salmon at <0.7g.
 - Above 3g, pink salmon are quite resistant to infection and readily shed lice.

- Generally, only the smallest out migrating pink salmon (0.3g) are prone to lethal effects of lice and very high levels of exposure.
 - This is in contradiction to the claims made by Morton and Routledge (2006) wherein they claim as few as 1-3 lice can have lethal effects.
 - Further assessment of the Cermaq vs independent monitoring of sea lice levels is required
- “It was a certainty that, over time, sea lice in the North Pacific would develop SLICE resistance”
 - This is not a certainty given that sea lice in BC are different compared to populations and species in other regions. It has been repeatedly demonstrated by industry that SLICE susceptibility is retained following the influx of naïve sea lice on in-migrating Pacific salmon each year, creating a “parasite refuge” of susceptible species.
 - It would be beneficial to collate and publish this data and compare it with DFO audit information to provide evidence of this information
- “*Why alternate treatments were not immediately made obligatory remains a mystery*”
 - It is not a mystery – it has been shown that BC sea lice populations retain susceptibility after fallowing of sites. Historically it had not been necessary to employ alternate treatment modalities (e.g., Hydrolyzer and Thermolyzer) because SLICE has usually retained its efficacy. Industry has only recently employed these modalities due to resistance concerns.
 - Additionally, as described above, the approval for use of alternate treatments has been greatly slowed due to backlash experienced during the public approval process for such treatments.
- “*SLICE continued to be used, and used in repeat treatments, at farms where the lice were clearly resistant to it. This may have accelerated the development of resistance during..*”
 - Industry veterinarians routinely use bioassays in advance of a SLICE treatment to minimize the risk of a treatment failure due to SLICE resistant louse population.
 - Industry does not use SLICE in the face of known resistance
- “*Regardless where SLICE resistant lice may be today, it will soon be the case that sea lice cannot be controlled at any BC open netpen salmon farm*”
 - This statement is baseless speculation. SLICE has been in use in BC for many years and evidence shows that efficacy is maintained in most regions as described above. There is no evidence that currently suggests that SLICE will not be efficacious at all farms in BC.
- “It has brought us to a place where we are left with lousy choices, simply put: increasingly toxic chemicals being dumped directly into the marine environment”
 - There is no evidence that increasingly toxic chemicals are being dumped at farm sites. This statement contradicts the earlier comment that no methods have been approved for use for sea lice management

- Hydrogen peroxide is an environmentally safe treatment choice and has been used as a part of integrated pest management by industry
 - Industry is currently working on obtaining more tools such as the Hydro- and Thermo-lyzers for use in the case that resistance should occur
- *“Sea lice have been identified as a cause of population level declines in pink salmon in the Broughton...”*
 - This has not been definitely proven; population levels have been stable for Pink salmon in this region to date
 - [REDACTED] and company have repeatedly predicted the extirpation of pink salmon (and demise of Pacific salmon broadly) as a result of sea lice since 2006. To date none of their predictions have come to pass, and should be considered demonstrably false.

Why are sea lice of concern?

- *“So when juvenile salmon begin emerging in spring there are few if any lice in coastal waters”*
 - Lice likely reside in coastal waters year round on resident reservoirs (eg. Three-spine stickleback) so this statement cannot be supported by fact.
- *“Farms act as lice incubators, increasing lice abundance dramatically over natural levels”*
 - This is a known risk factor, despite the hyperbolic language used
- *“Larval lice can travel 30km on marine currents”*
 - I could not access the article cited that supports this claim, but the title/abstract explains it is a laboratory study, so I cannot see how it would support the statement cited above. I think this reference relates to the number of lice eggs produced, but cannot speak to the distance in which those eggs travel from the source, this would be site-specific based on local hydrogeological factors.
 - Numerous other papers identify that louse transmission between farms drops off
- *“As a consequence (of issues related to sea lice), more land-based salmon farm capacity, which eliminates marine parasites from the equation, is being developed nearly everywhere”*
 - Land-based operations are still in the research-phase and have not replaced ocean-based salmon farming in any region. There is no evidence stated in this document or that I could find supporting the above claim that salmon farmers are turning to land-based operations solely due to issues in managing sea lice.
 - From an environmental perspective, land-based farming of salmon is much less sustainable than farming in the ocean. The energy requirements, carbon footprint, and land requirements are massive and the risks are only mitigated with significant treatment of all incoming water, and effluent.

s.19(1)

What happened in Clayoquot Sound in 2018?

- *“limited publically available information on treatment” “Neither Cermaq nor DFO publically releases records of the drug treatments applied to farmed salmon”*
 - All pesticide use (Paramove 50 (hydrogen peroxide) being one) are reported under the annual AAR report??? Treatment data
- *“Pattern of peaking and troughing in Clayquot during 2018...suggestive of repeated, ineffective treatments which promotes the development of drug resistant lice”*
 - This is untrue. There was no repeated treatments during the outmigration period of 2018 at Bawden (the data they are referring to). The cyclic nature in the counts could be due to environmental effects, population dynamics, counting bias or any other of a host of reasons.
- *“In 2018, the outlook for all stocks on the WCVI was poor, with no data reported for pink salmon and all other spp”*
 - There is no citation or data present to support this claim in this document
- *“It is perhaps important to mention here that we do not know that these farms were, in fact, treated with SLICE; other drugs or chemicals could have been used with emergency approval or a vet’s prescription of an off-label use of another approved drug”*
 - The authors are trying to lead the reader into believing that alternative drugs have been used in the Clayoquot region without providing a shred of evidence to support their claim. Any use of a pesticide would need to be permitted through the provincial Ministry of Environment, and any use of an in-feed drug (including on an emergency basis), would be reported to DFO. DFO veterinarians are contracted by the Veterinary Drugs Directorate for comment following all applications for an Emergency Drug Release.
- *“On a literal reading of the policy, no breach of license conditions occurred because lice inventories did decrease”*
 - This is an inaccurate interpretation of the COL – the fact that Cermaq failed to reduce “absolute sea lice inventory” on numerous farms within 15 days (or at all), during the 2018 outmigration is the basis for the current review being undertaken by C and P.
- *“There is no information to suggest that Cermaq was fined for delays in implementing effective treatment”*
 - This is correct – DFO does not currently have the ability to fine license holders as a means to support/enforce the conditions of license

How long has this been going on?

- *“According to this theory, the new lice infused the farmed lice populations with fresh genetics, resetting drug resistance towards zero. This theory should have been ground-truthed by tracking the response of lice to SLICE in a systematic way”*
 - Yes this should be done historically for all sea lice and SLICE use in BC

- Future iterations of the COL should have mandatory SLICE efficacy reporting to ensure judicious use by companies, and track any resistance emergence.
- Currently DFO is partnering with epidemiologists at CFIA to determine the various risk factors for SLICE resistance in BC.

The coverup

- *“DFO has been aware of developing drug resistance in sea lice on BC salmon farms since 2014, despite public denials...”*
 - The article is misunderstanding the issue they are presenting. They state that they have evidence that there was resistance developing in the Broughton in 2014, and that this means resistance will be present in this region forever. Bioassay reports from industry have confirmed that previous resistance they have seen is no longer present and SLICE remains efficacious in these regions
 - Perhaps it would be wise to summarize this information more clearly. It is not true that resistance popping up in one region means that it is there forever, and it should be possible to support this with data from industry.
 - The data from the Jones/Stewart funding does need to be published
 - Citation #15 (*“drug resistance report had been in error”*) is from a personal communication and not reported fact – there is no clear evidence that DFO denied the presence of resistance

BC Minister’s Advisory Council misled

- 2017 MAACFA Report → Resistance not discussed as it had not yet been a widespread problem, thus in most regions it is true that sea lice in BC “are still effectively controlled by current management measures”
 - The article is catastrophizing the presence of resistance at one site and making blanket statements about the whole region based on this finding. It is not accurate to claim presence of a coverup for all of BC regarding resistance issues.
- *“The advent of drug-resistant sea lice takes BC into an entirely new regime of lice management, in which toxic chemicals will be dumped into the ocean”*
 - This is speculative, inflammatory and untrue.
- *“An attempt to mislead the Council and the public; or an inexcusable failure to communicate critical information about drug resistance to senior officials within the DFO”*
 - Article is attempting to lead readers to 1 of 2 conclusions when the situation is more complicated than presented

What are these lice levels doing to the wild fish?

- *“There is no direct linkage between levels of infestation on wild juveniles and management measures required to be taken on farms”*

- The papers cited in this section have been widely refuted by reputable scientists due to inappropriate scientific methods and the conclusions they make cannot be extrapolated to population-level conclusions
- Presence of lice on herring → claim that this has only been an issue since 2008.. but was anyone even looking for lice on herring prior to this?
 - There is excellent Traditional Ecologic Knowledge (TEK) that herring routinely are infested with *Caligus* species louse since time immemorial. Hence why the colloquial name for *Caligus clemensi* is “the herring louse”
 - The image of herring with *Caligus* lice on pg. 16 was taken following a herring mortality event in Clayoquot in 2018 near Hot Springs Cove. The cause was later determined to be VHSV, which is a known viral infection harboured by herring, and known to cause large-scale die off occasionally. The virally compromised herring were likely more susceptible to louse infestation prior to death. To imply that the louse burden itself was fatal is disingenuous.
- Sea lice data on wild fish study comparison:
 - Numbers are possibly misleading; variable sample sizes
 - Where does Cermaq sample vs the competing study? A map depicting the sampling locations would be useful. Further assessment comparing these studies is warranted.
 - The link provided to the Cedar Coast Study on pg. 18 doesn't link to the report cited, so it is not possible to review their data.
- The text explaining the Figure 5 is wrong. The authors claim that “For chum salmon, 60 percent were infected with more than 2 lice.”
 - In fact, if you look at the figure below you can clearly see that the vast majority of chum sampled (>80%) has *less* than two lice infesting them.

Where do we go from here?

- Issues regarding licensing the use of Salmosan bath treatments is under the jurisdiction of the province.
 - There is no indication that companies in BC wish to pursue the use of this bath treatment in BC.
- The discussion on the licensing of Salmosan is premature given the lack of any intention of this treatment to be used in BC. Further, the allegation that environmental effects in BC would not be considered is untrue.

Resistance and IPM

“This is the known trajectory of sea louse treatment: more toxic chemicals, used more frequently and often in combination, lasting longer in the environment and having unknown potential impacts on Pacific species.”

- This is not true in BC. The current trend by industry is towards a reduced reliance on SLICE, and no “toxic chemicals” have ever been employed in BC to control lice.
- New treatment modalities, and husbandry practices are becoming widely adopted along the coast, which are reducing the reliance on SLICE to manage lice on farms.
 - Some examples include: mechanical removal technologies (eg. hydrolicer), hydrogen peroxide treatment, area-based management (eg. Coordinated treatments, stocking and fallowing of farms in an area) and pre-treatment of smolts in the hatchery with anti-louse medication.
 - The rotational use of these technologies is part of an Integrated Pest Management approach, which has been demonstrated to reduce the need for drugs/pesticides, and prevent the development of resistance



Fisheries and Oceans
Canada

Pêches et Océans
Canada

Pacific Region

Région du Pacifique

Regional Director General

Directrice générale régionale

UNCLASSIFIED
2018-502-00102
EKME #: 3927857

MEMORANDUM FOR THE DEPUTY MINISTER

**SEA LICE MANAGEMENT ISSUE IN PACIFIC REGION
(FOR INFORMATION)**

SUMMARY OF ADVICE TO DEPUTY MINISTER

The purpose of this note is to bring to your attention a growing pattern of sea lice management challenges in British Columbia.

Within the last three years the department has become aware of elevated sea lice levels for a variety of sites in Klemtu in 2015, Esperanza Inlet in 2017 and now Clayoquot Sound in 2018. Currently management approaches have not been effective to reduce the lice loads.

This situation has raised media attention and public concern over potential harm to salmon smolts during out migration periods. The Department is planning to take action to address the shortcomings of sea lice management approaches in the Pacific Region.

Immediate next steps include internal discussions [REDACTED] and continued collaboration with [REDACTED] Communications to respond to media and public inquiries should they arise.

Medium to long term actions will include consultation with Science Branch, Industry, British Columbia and potentially others such as First Nations on improved Integrated Pest Management approaches and potential changes to condition of licence.

BACKGROUND

Numerous Salmon farms in Clayoquot Sound, operated by Cermaq on the West Coast of Vancouver Island, are experiencing extremely high sea lice counts (80 to 100 lice per fish) this spring. When lice levels cannot be managed there is a risk of spillover of farmed lice onto migrating smolts increasing the risk of detrimental effects to wild fish.

s.21(1)(b)

s.23

.../2

At present, there are few options available to the aquaculture industry to reduce the sea lice loads below the DFO threshold. Until recently, the only drug available has been emamectin benzoate known as SLICE. Area based SLICE treatments conducted in September and early October 2017 in Clayoquot had much lower effect than expected and resulted in lice numbers remaining high into 2018. Aquaculture Management staff have collected sea lice samples from one of the 7 sites over regulatory thresholds and have confirmed SLICE resistance.

Alternative treatment was pursued by Cermaq however their application which requires approval by the BC Ministry of Environment for the use of hydrogen peroxide (Paramove) was delayed by public opposition/consultation in Tofino. As a result their only management option remaining was harvest.

Accelerated harvest is challenged by capacity at processing plants and harvest vessels limiting its effectiveness as a management tool. In the case of Clayoquot in 2018, there were also demands for harvesting efforts to be redirected other farms to ensure they remained below the maximum tonnage of fish allowed on the farm according to conditions of licence (CoL). Failure to harvest on an accelerated timeline increases the risk to wild outmigrating salmon smolts and may represent non-compliance with CoL.

STRATEGIC CONSIDERATIONS

This situation has highlighted the shortcomings of “harvest” as a management tool since harvest capacity at processing plants and harvest vessels is fixed and companies try to ensure they maintain peak efficiencies; therefore there is generally not additional capacity to allow harvesting as a management tool. This limitation has been encountered with all three major salmon farming companies, in three of the past four outmigration periods.

DFO Aquaculture Management is considering different options such as mandatory fallowing as well as further research into the thresholds used for regulatory management of sea lice.

Industry is aware of this situation and generally supportive of considering alternative management approaches. In this current situation, Cermaq has voluntarily withdrawn their Aquaculture Stewardship Certification in recognition of this issue.

Any options will require consultation with First Nations as well as industry and BC.

s.21(1)(a)

There was initial media interest in this issue in Clayoquot Sound, but this has subsided.

s.21(1)(b)

Aquaculture Management will work with Communications as any changes are contemplated.

s.23

.../3

SCIENCE ADVICE

DFO Aquaculture will consider whether more research is necessary [REDACTED] and work with Science as appropriate.

INTERDEPARTMENTAL CONSULTATIONS

N/A

INDIGENOUS CONSULTATIONS

Once options are identified, DFO will consider the most appropriate approach to consultations with First Nations.

EXTERNAL CONSULTATIONS

Aquaculture Management plans to engage with industry and BC through our advisory process to highlight the need for an improved approach to management going forward.

ADVICE AND RECOMMENDATIONS TO DEPUTY MINISTER

Further briefings will be forthcoming when options are developed.

Rebecca Reid
Regional Director General

s.21(1)(b)

s.23



UNCLASSIFIED
GCCMS #: 2018-502-00102
EKME #: 3927857

To: Catherine Blewett
Pour:

Date:

Object: **SEA LICE MANAGEMENT ISSUE IN PACIFIC REGION**
Objet:

From / Andrew Thomson, Regional Director, Fisheries Management
De:

Via: Rebecca Reid, Regional Director General, Pacific Region

Additional approvals:
Autre(s) approbation(s):

☐ Material for the Minister
Documents pour le Ministre

☐ Your Signature
Votre signature

☒ Information

Screen: The Department has assessed this issue in full.
Filtre: ☒ It contains no reference to matters covered by the screen relating to J.D. Irving Limited.
☐ It contains matters referenced in the screen relating to J.D. Irving Limited, but in our view does not engage the screen.
☐ In our view, the screen relating to J.D. Irving Limited should be engaged.

Remarks: This briefing note was developed in consultation with the following
Remarques: regions/sectors:

Distribution:

Drafting Officer/
Rédacteur:

Adrienne Paylor (250)-286-5817/ Allison Webb / pd

Rainer, Michelle

From: Rainer, Michelle
Sent: November-01-18 9:42 AM
To: McNabb, Melanie
Subject: Re: Aquaculture ride-along

Sent from my BlackBerry 10 smartphone on the Rogers network.

From: McNabb, Melanie
Sent: Wednesday, October 31, 2018 5:35 PM
To: Rainer, Michelle
Subject: Re: Aquaculture ride-along

Sent from my BlackBerry 10 smartphone on the Rogers network.

From: Rainer, Michelle
Sent: Wednesday, October 31, 2018 4:37 PM
To: McNabb, Melanie
Subject: Re: Aquaculture ride-along

Thanks, Mel sounds great!

:p

Sent from my BlackBerry 10 smartphone on the Rogers network.

From: McNabb, Melanie
Sent: Wednesday, October 31, 2018 4:17 PM
To: Rainer, Michelle
Subject: Re: Aquaculture ride-along

Thanks! I cribbed from this to respond to [REDACTED] request. I'm planning a quick call for next week just to close the loop with industry and see if there is interest in doing more activities like this.

Sent from my BlackBerry 10 smartphone on the Rogers network.

From: Rainer, Michelle
Sent: Wednesday, October 31, 2018 3:24 PM
To: Webb, Allison
Cc: McNabb, Melanie
Subject: FW: Aquaculture ride-along

Hi Allison,
A quick summary of today for you.

Fish audit ride-along

Participated in a ride-along with staff from DFO's Fish Health Audit and Surveillance program. Reporters observed a fish health and sea lice audit and learned out our monitoring and auditing program. Significant attention was paid to the recent Living Oceans report on sea lice in Clayoquot Sound and Zac answered a number of questions on Cermaq

Canada's lice management, SLICE resistance, the effects of lice on farmed and wild salmon and what actions DFO might take in response. Kerra did a great interview on our management in general, why we invited media to the audit, the data we make available to the public and our wish to increase public knowledge and trust in our regulation.

Spokespersons: Zac Waddington, Kerra Shaw

[REDACTED] Campbell River Mirror

office: 250-287-9227 x [REDACTED]

cell: [REDACTED]

[REDACTED] Star Metro Vancouver

cell: [REDACTED]

[REDACTED] CTV

C [REDACTED]

Cell: [REDACTED]

[REDACTED] The Canadian Press (photos only)

s.19(1)

Bate, Dan

From: Bate, Dan
Sent: November-01-18 10:41 AM
To: Waddington, Zac; Webb, Allison
Cc: Paylor, Adrienne; Rainer, Michelle
Subject: RE: For Approval: SeaWestNews, Reaction to reports on sea lice in Clayoquot Sound

Thanks all.. re-editing and will send for further approvals later this am.

D

From: Waddington, Zac
Sent: November-01-18 10:36 AM
To: Webb, Allison; Bate, Dan
Cc: Paylor, Adrienne; Rainer, Michelle
Subject: RE: For Approval: SeaWestNews, Reaction to reports on sea lice in Clayoquot Sound

I agree with Allison's comments below

Zac

From: Webb, Allison
Sent: November-01-18 10:28 AM
To: Waddington, Zac; Bate, Dan
Cc: Paylor, Adrienne; Rainer, Michelle
Subject: RE: For Approval: SeaWestNews, Reaction to reports on sea lice in Clayoquot Sound

Just a few minor changes for consideration to add to what Zac has provided. See below. Tx.

Given the number of stories already out, not sure how best to handle this item.

Thanks,
Allison

Allison Webb, Director / Directrice
Aquaculture Management / Gestion de l'aquaculture
Fisheries Management Branch / Direction de la gestion des pêches
Fisheries and Oceans Canada / Pêches et Océans Canada
200 - 401 Burrard St / Rue Burrard, Vancouver BC / C.B. V6C 3S4 Canada
604-666-7009
Allison.webb@dfo-mpo.gc.ca

From: Waddington, Zac
Sent: Wednesday, October 31, 2018 4:55 PM
To: Webb, Allison <Allison.Webb@dfo-mpo.gc.ca>; Bate, Dan <Dan.Bate@dfo-mpo.gc.ca>
Cc: Paylor, Adrienne <Adrienne.Paylor@dfo-mpo.gc.ca>; Rainer, Michelle <Michelle.Rainer@dfo-mpo.gc.ca>
Subject: RE: For Approval: SeaWestNews, Reaction to reports on sea lice in Clayoquot Sound

Here's my attempt to respond to the follow-up questions from the media:

"Sea lice are "out of control" at salmon farms on the west coast of B.C. this year because they have become drug resistant"

- Sea lice levels were above threshold in a majority of Atlantic salmon farms (eleven total) in the Clayoquot region during the 2018 outmigration period, which was in part due to drug (SLICE) resistance,
 - In the rest of BC, only three farms had relatively brief and minor periods where lice levels were over the three motile threshold during the 2018 outmigration period, and not due to SLICE resistance.
- Prior to 2017, more than 95% of SLICE treatments in the Clayoquot area were considered to be effective.
 - Ineffective treatment is not necessarily due to resistance. It may be a result of: poor feed uptake, poor timing of treatment and/or environmental events (low dissolved oxygen, harmful algal blooms, weather events etc.) which prevent a proper feeding.
- In regions where SLICE resistance has emerged in the past it has been able to be reversed by a period of abstinence from SLICE use, and a "refreshing" of the lice genetics from subsequent wild salmon returns.
- New treatment modalities, and husbandry practices are becoming widely adopted along the coast, which are reducing the reliance on SLICE to manage lice on farms.
 - Some examples include: mechanical removal technologies (eg. hydrolicer), hydrogen peroxide treatment, area-based management (eg. Coordinated treatments, stocking and fallowing of farms in an area) and pre-treatment of smolts in the hatchery with anti-louse medication.
 - The rotational use of these technologies is part of an Integrated Pest Management approach, which has been demonstrated to reduce the need for drugs/pesticides, and prevent the development of resistance

The report claims Fisheries and Oceans Canada knew as early as 2014 that resistance was developing in sea lice, but did not take measures to ensure the protection of wild juvenile salmon from the parasite. Measures could have included alternate treatments for sea lice ready for deployment when SLICE failed,

- DFO has supported the development and licencing of new lice treatment modalities and continues to work in collaboration with BC and industry to make advancements in this area to address sea lice while minimising environmental impacts and risks to wild fish
 - Some examples include: the licencing for hydrogen peroxide use in BC, research into cleaner fish, development of models to support area-based management, research into risk factors for SLICE resistance, the licencing Imvixa (an in-feed drug used in hatchery to confer up to 9 months protection from sea louse infestation), funding for implementation of various green technologies on farm (FACTAP).

Since 2014, companies have made significant investments in mechanical removal technologies (hydrolicer), hosted workshops on Integrated Pest Management techniques, purchased and ordered well boats to facilitate peroxide and fresh water bath treatments, gained pesticide use [may not wish to indicate what industry is doing specifically, but focus on DFO work]

From: Webb, Allison
Sent: October-31-18 4:34 PM
To: Bate, Dan
Cc: Waddington, Zac; Paylor, Adrienne; Rainer, Michelle
Subject: RE: For Approval: SeaWestNews, Reaction to reports on sea lice in Clayoquot Sound

Draft Lines for response to withholding info for MACCFA (Andy's request) – needs more work

- MACCFA is a provincial led process of which DFO was not a member, but rather attended a few meetings at the request of the Committee to provide responses to specific questions. The Committee did not request

information on sea lice exceedance so it is untrue to indicate that this information was withheld. [this needs to be fully verified by Andy Thomson]

- Sea lice data is posted publicly on DFO's website and is updated regularly for increased transparency so claims that DFO is deliberately hiding data are untrue.

Allison Webb, Director / Directrice
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Fisheries Management Branch / Direction de la gestion des pêches
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From: Bate, Dan
Sent: Wednesday, October 31, 2018 3:15 PM
To: Webb, Allison <Allison.Webb@dfo-mpo.gc.ca>
Cc: Waddington, Zac <Zac.Waddington@dfo-mpo.gc.ca>; Paylor, Adrienne <Adrienne.Paylor@dfo-mpo.gc.ca>; Rainer, Michelle <Michelle.Rainer@dfo-mpo.gc.ca>
Subject: For Approval: SeaWestNews, Reaction to reports on sea lice in Clayoquot Sound
Importance: High

Hi Allison - Michelle is up in Campbell River wrapping up today's media tour - reports back say things went really well and that 5 outlets were in attendance.
In her absence I've been stick handling this request with Adrienne.

Here with additional responses to a media request earlier today.
I note that Andy also requested additional points yesterday to address the report.

Thanks,
Dan

Issue: Reporter [REDACTED] has been in contact with the Department regarding a recent report from Living Oceans about the increase in Sea Lice resistance on the BC Coast. Reporter was sent earlier set of MINO approved lines, but has come back with additional questions.

Recommendation: Provide the following QA's to the reporter by email.

Approved by: Adrienne Paylor, Zac Waddington

Questions and Answers:

Q: The report states that sea lice are "out of control" at salmon farms on the west coast of B.C. this year because they have become drug resistant. Is this statement true?

- Sea lice abundance is monitored at all active farm sites in BC and a portion are audited by the department of Fisheries and Oceans on a quarterly basis. All sea lice abundance data and audit results are publically reported. During most years, more than 90% of sites in BC are below the regulatory thresholds for sea lice during the wild salmon outmigration period (from March 1 to June 30 of each year).
- DFO has been working with the province of BC and industry to develop alternative tools to manage sea lice
- During the 2018 outmigration period, sites culturing Atlantic Salmon in the Clayoquot region and 3 sites in the Nootka area were identified with an over threshold of sea lice abundance.

- Sites experiencing sea lice exceedance have been able to manage lice with effective treatments of SLICE in. From 2011-2017 approximately 90% of SLICE treatments have shown acceptable efficacy, and when reduced efficacy was observed alternative treatments such as Hydrogen Peroxide have been implemented.
- DFO regulators have watched carefully for indication of SLICE resistance. In cases where the use of SLICE does not result in adequate reduction of sea lice, companies can apply to the province of British Columbia for a permit to use alternative treatments, including Paramove (a hydrogen peroxide bath). Please contact Cermaq or the Province of BC's Ministry of Environment for further information on this process.
- Hydrogen peroxide is used widely world-wide, including elsewhere on Canada's west coast, with excellent efficacy and no demonstrable effects to the ecosystem. This pesticide is not absorbed by the fish and is non-toxic to humans. It also dissipates as a neutralized substance (oxygen and water) quickly in the environment, causing no discernible far-field effect

Q: The report claims Fisheries and Oceans Canada knew as early as 2014 that resistance was developing in sea lice, but did not take measures to ensure the protection of wild juvenile salmon from the parasite. Measures could have included alternate treatments for sea lice ready for deployment when SLICE failed. Is this an accurate depiction?

- DFO has been actively monitoring and analysing sea lice data for indication of SLICE resistance since 2011 and first noted concerns at Klemtu in 2015, Esperanza Inlet in 2017, and now Clayoquot Sound in 2018.
- Since the monitoring numbers in Clayoquot Sound from this spring was the strongest indication of SLICE resistance to date, DFO took action to perform a targeted audit and collected sea lice samples from Cermaq Canada's Bawden site and sent them to the BC Centre for Aquatic Health Sciences for analysis. SLICE resistance was confirmed by the lab. Samples were later sent to the Atlantic Veterinary College which is currently undertaking work to better understand SLICE resistance.
- DFO has taken significant action and is currently investigating the management of lice at farms in Clayoquot by Cermaq Canada to determine if there has been non-compliance with the licence conditions. Due to the active investigation we cannot comment further at this time.

Q: The report claims that DFO has been contacted to comment on these claims, but that a Vancouver Sun reporter never received a response. Cermaq has also been contacted. Neither DFO or Cermaq release public records of the drug treatments used on farmed salmon. Is this true?

- In BC under DFO's Pacific Aquaculture Regulations all infeed treatments are publicly reported in the sea lice abundance reports online.
- In addition, DFO publicly reports the quantity of all drugs and pesticides deposited at each aquaculture facility under the national Aquaculture Activities Regulations (AAR). This information is posted on an annual basis starting in 2016 when the regulation came into effect. The 2017 report is currently being processed for posting.

Dan Bate

Team Lead, Communications
Fisheries and Oceans Canada Pacific Region / Canadian Coast Guard / Government of Canada
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s.16(2)(c)

Bate, Dan

From: Thomson, Andrew
Sent: November-01-18 12:37 PM
To: Bate, Dan
Cc: Webb, Allison; Rainer, Michelle
Subject: Re: For Approval: SeaWestNews, Reaction to reports on sea lice in Clayoquot Sound

Approved

Andrew J L Thomson

Regional Director | Directeur Régionale
Fisheries Management Branch | Direction de la gestion des pêches
Pacific Region | Région du Pacifique
Fisheries & Oceans Canada | Pêches et Océans Canada

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Facsimile | Télécopieur 250.666.8069
Government of Canada | Gouvernement du Canada.

From: Bate, Dan
Sent: Thursday, November 1, 2018 12:33 PM
To: Thomson, Andrew
Cc: Webb, Allison; Rainer, Michelle
Subject: For Approval: SeaWestNews, Reaction to reports on sea lice in Clayoquot Sound

Hi Andy - understand were looking for enhanced lines on this issue.
Looking for your approval on the following.

Thanks much,
Dan

Issue: Reporter [REDACTED] has been in contact with the Department regarding a recent report from Living Oceans about the increase in Sea Lice resistance on the BC Coast. Reporter was sent earlier set of MINO approved lines, but has come back with additional questions.

Recommendation: Provide the following QA's to the reporter by email.

Approved by: Adrienne Paylor, Zac Waddington, Allison Webb,

Questions and Answers:

Q: The report states that sea lice are “out of control” at salmon farms on the west coast of B.C. this year because they have become drug resistant. Is this statement true?

s.19(1)

- Sea lice levels were above threshold in a majority of Atlantic salmon sites (eleven total) in the Clayoquot region during the 2018 outmigration period. In the rest of BC, only three sites had relatively brief and minor periods where lice levels were over the threshold during this same period.
- DFO regulators have watched carefully for indication of SLICE resistance.
- Ineffective SLICE treatment is not necessarily due to resistance. It may be a result of: poor feed uptake, poor timing of treatment and/or environmental events (including low dissolved oxygen, harmful algal blooms, weather events etc.) which prevent a proper feeding. Prior to 2017, more than 95% of SLICE treatments in the Clayoquot area were considered to be effective.
- In regions where ineffective SLICE treatment has emerged, in the past it has been able to be reversed by a period of discontinuing SLICE use, and a introduction of genetically different lice from wild fish. In cases where the use of SLICE does not result in adequate reduction of sea lice, companies can apply to the province of British Columbia for a permit to use alternative treatments, including Paramcve (a hydrogen peroxide bath). Please contact Cermaq or the Province of BC's Ministry of Environment for further information on this process.
- DFO has been working with the province of BC and industry to develop alternative tools to manage sea lice. New treatment methodology, and husbandry practices are becoming widely adopted along the coast, which are reducing the reliance on SLICE to manage lice at sites. Some examples include: mechanical removal technologies (eg. hydrolicer), hydrogen peroxide treatment, area-based management (eg. coordinated treatments, stocking and fallowing of sites in an area) and pre-treatment of smolts in the hatchery with anti-lice medication. The rotational use of these technologies is part of an Integrated Pest Management approach, which has been demonstrated to reduce the need for drugs/pesticides, and prevent the development of resistance.

Q: The report claims Fisheries and Oceans Canada knew as early as 2014 that resistance was developing in sea lice, but did not take measures to ensure the protection of wild juvenile salmon from the parasite. Measures could have included alternate treatments for sea lice ready for deployment when SLICE failed. Is this an accurate depiction?

- DFO regulators have watched carefully for indication of SLICE resistance. DFO has been actively monitoring and analysing sea lice data for indication of SLICE resistance since 2011 and first noted concerns at Klemtu in 2015, Esperanza Inlet in 2017, and now Clayoquot Sound in 2018
- Since the monitoring numbers in Clayoquot Sound from this spring was the strongest indication of ineffective SLICE treatment to date, DFO took action to perform a targeted audit and collected sea lice samples from Cermaq Canada's Bawden site and sent them to the BC Centre for Aquatic Health Sciences for analysis. SLICE resistance was confirmed by the lab. Samples were later sent to the Atlantic Veterinary College which is currently undertaking work to better understand SLICE resistance.
- DFO has supported the development and licencing of new lice treatment methodologies and continues to work in collaboration with BC and industry to make advancements in this area to address sea lice while minimising environmental impacts and risks to wild fish.
- Some examples include: the licencing for hydrogen peroxide use in BC, research into sea lice eating fish species, development of models to support area-based management, research into risk factors for SLICE resistance, the licencing of *Imvixá* (an in-feed drug used in hatchery to confer up to 9 months protection from sea louse infestation), and funding for implementation of various green technologies on sites.
- In addition, since 2014, industry has made significant investments in mechanical removal technologies (hydrolicer), hosted workshops on Integrated Pest Management techniques, and purchased and ordered well boats to facilitate peroxide and fresh water bath treatments.

- DFO has taken significant action and is currently investigating the management of lice at sites in Clayoquot by Cermaq Canada to determine if there has been non-compliance with the licence conditions. Due to the active investigation we cannot comment further at this time.

Q: The report claims that DFO has been contacted to comment on these claims, but that a Vancouver Sun reporter never received a response. Cermaq has also been contacted. Neither DFO or Cermaq release public records of the drug treatments used on farmed salmon. Is this true?

- In BC under DFO's Pacific Aquaculture Regulations all infeed treatments are publicly reported in the sea lice abundance reports online.
- In addition, DFO publicly reports the quantity of all drugs and pesticides deposited at each aquaculture facility under the national Aquaculture Activities Regulations (AAR). This information is posted on an annual basis starting in 2016 when the regulation came into effect. The 2017 report is currently being processed for posting. Please see: <http://www.dfo-mpo.gc.ca/aquaculture/management-gestion/apr-rpa-reporting-eng.htm>

Q: Has the Department been withholding information from The Minister of Agriculture's Advisory Council on Finfish Aquaculture (MAACFA)?

- The Minister of Agriculture's Advisory Council on Finfish Aquaculture (MAACFA) is a province of BC led process of which DFO has not been a member, however it has attended a few meetings at the request of the Council to provide responses to specific questions. [REDACTED]
- Sea lice data is posted publicly on DFO's website and is updated regularly for increased transparency. Claims that DFO is deliberately hiding data are untrue.

Dan Bate

Team Lead, Communications

Fisheries and Oceans Canada Pacific Region / Canadian Coast Guard / Government of Canada

Dan.Bate@dfo-mpo.gc.ca / Tel: (604) 775-8809 / Cell: [REDACTED]

Chef d'équipe, communications

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Dan.Bate@dfo-mpo.gc.ca / Tél : (604) 775-8809 / Tél. cell. : [REDACTED]

s.16(2)(c)

s.21(1)(a)

s.21(1)(b)

Bate, Dan

From: Webb, Allison
Sent: November-01-18 1:00 PM
To: Bate, Dan; Thomson, Andrew
Cc: Rainer, Michelle
Subject: RE: For Approval: SeaWestNews, Reaction to reports on sea lice in Clayoquot Sound

We should remove the last sentence re MAACFA and may need to redraft. I just spoke to Andy about it and we can not 100% confirm that it's correct [REDACTED]

- The Minister of Agriculture's Advisory Council on Finfish Aquaculture (MAACFA) is a province of BC led process of which DFO has not been a member, however DFO officials attended a few meetings at the request of the Council to provide responses to specific questions and provided the most up to date available information at that time.

Allison Webb, Director / Directrice
Aquaculture Management / Gestion de l'aquaculture
Fisheries Management Branch / Direction de la gestion des pêches
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604-666-7009
Allison.webb@dfo-mpo.gc.ca

From: Bate, Dan
Sent: Thursday, November 1, 2018 12:33 PM
To: Thomson, Andrew <Andrew.Thomson@dfo-mpo.gc.ca>
Cc: Webb, Allison <Allison.Webb@dfo-mpo.gc.ca>; Rainer, Michelle <Michelle.Rainer@dfo-mpo.gc.ca>
Subject: For Approval: SeaWestNews, Reaction to reports on sea lice in Clayoquot Sound

Hi Andy - understand were looking for enhanced lines on this issue.
Looking for your approval on the following.

s.19(1)
s.21(1)(a)
s.21(1)(b)

Thanks much,
Dan

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Recommendation: Provide the following QA's to the reporter by email.

Approved by: Adrienne Paylor, Zac Waddington, Allison Webb,

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- DFO has been working with the province of BC and industry to develop alternative tools to manage sea lice. New treatment methodology, and husbandry practices are becoming widely adopted along the coast, which are reducing the reliance on SLICE to manage lice at sites. Some examples include: mechanical removal technologies (eg. hydrolicer), hydrogen peroxide treatment, area-based management (eg. coordinated treatments, stocking and fallowing of sites in an area) and pre-treatment of smolts in the hatchery with anti-lice medication. The rotational use of these technologies is part of an Integrated Pest Management approach, which has been demonstrated to reduce the need for drugs/pesticides, and prevent the development of resistance.

Q: The report claims Fisheries and Oceans Canada knew as early as 2014 that resistance was developing in sea lice, but did not take measures to ensure the protection of wild juvenile salmon from the parasite. Measures could have included alternate treatments for sea lice ready for deployment when SLICE failed. Is this an accurate depiction?

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- Some examples include: the licencing for hydrogen peroxide use in BC, research into sea lice eating fish species, development of models to support area-based management, research into risk factors for SLICE resistance, the licencing of *Imvixa* (an in-feed drug used in hatchery to confer up to 9 months protection from sea louse infestation), and funding for implementation of various green technologies on sites.
- In addition, since 2014, industry has made significant investments in mechanical removal technologies (hydrolicer), hosted workshops on Integrated Pest Management techniques, and purchased and ordered well boats to facilitate peroxide and fresh water bath treatments.
- DFO has taken significant action and is currently investigating the management of lice at sites in Clayoquot by Cermaq Canada to determine if there has been non-compliance with the licence conditions. Due to the active investigation we cannot comment further at this time.

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Dan Bate

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s.16(2)(c)

s.21(1)(a)

s.21(1)(b)

Bate, Dan

From: Bate, Dan
Sent: November-01-18 2:02 PM
To: Girouard, Louise
Cc: Rainer, Michelle
Subject: For Approval: SeaWestNews, Reaction to reports on sea lice in Clayoquot Sound

Hey Louise - passing over to you for approval.

D

Issue: Reporter [REDACTED] has been in contact with the Department regarding a recent report from Living Oceans about the increase in Sea Lice resistance on the BC Coast. Reporter was sent earlier set of MINO approved lines, but has come back with additional questions.

Recommendation: Provide the following QA's to the reporter by email.

Approved by: Adrienne Paylor, Zac Waddington, Allison Webb, Andrew Thompson

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- In addition, since 2014, industry has made significant investments in mechanical removal technologies (hydrolicer), hosted workshops on Integrated Pest Management techniques, and purchased and ordered well boats to facilitate peroxide and fresh water bath treatments.
- DFO has taken significant action and is currently investigating the management of lice at sites in Clayoquot by Cermaq Canada to determine if there has been non-compliance with the licence conditions. Due to the active investigation we cannot comment further at this time.

Q: The report claims that DFO has been contacted to comment on these claims, but that a Vancouver Sun reporter never received a response. Cermaq has also been contacted. Neither DFO or Cermaq release public records of the drug treatments used on farmed salmon. Is this true?

- In BC under DFO's Pacific Aquaculture Regulations all infeed treatments are publicly reported in the sea lice abundance reports online.
- In addition, DFO publicly reports the quantity of all drugs and pesticides deposited at each aquaculture facility under the national Aquaculture Activities Regulations (AAR). This information is posted on an annual basis starting in 2016 when the regulation came into effect. The 2017 report is currently being processed for posting. Please see: <http://www.dfo-mpo.gc.ca/aquaculture/management-gestion/apr-rpa-reporting-eng.htm>

Q: Has the Department been withholding information from The Minister of Agriculture's Advisory Council on Finfish Aquaculture (MACCFA)?

- The Minister of Agriculture's Advisory Council on Finfish Aquaculture (MAACFA) is a province of BC led process of which DFO has not been a member, however it has attended a few meetings at the request of the Council to provide responses to specific questions and provided the most up to date available information at that time.
- Sea lice data is posted publicly on DFO's website and is updated regularly for increased transparency. Claims that DFO is deliberately hiding data are untrue.

s.16(2)(c)

Dan Bate

Team Lead, Communications
Fisheries and Oceans Canada Pacific Region / Canadian Coast Guard / Government of Canada
Dan.Bate@dfo-mpo.gc.ca / Tel: (604) 775-8809 / Cell: [REDACTED]

Chef d'équipe, communications

s.16(2)(c)

No further information has been removed or severed from this page

Delaney, Paula

From: Webb, Allison
Sent: November-01-18 2:13 PM
To: Bate, Dan; Thomson, Andrew
Cc: Rainer, Michelle
Subject: RE: For Approval: SeaWestNews, Reaction to reports on sea lice in Clayoquot Sound

Tx. Ok from my perspective.

Allison Webb, Director / Directrice
Aquaculture Management / Gestion de l'aquaculture
Fisheries Management Branch / Direction de la gestion des pêches
Fisheries and Oceans Canada / Pêches et Océans Canada
200 - 401 Burrard St / Rue Burrard, Vancouver BC / C.B. V6C 3S4 Canada
604-666-7009
Allison.webb@dfo-mpo.gc.ca

From: Bate, Dan
Sent: Thursday, November 1, 2018 1:58 PM
To: Webb, Allison <Allison.Webb@dfo-mpo.gc.ca>; Thomson, Andrew <Andrew.Thomson@dfo-mpo.gc.ca>
Cc: Rainer, Michelle <Michelle.Rainer@dfo-mpo.gc.ca>
Subject: RE: For Approval: SeaWestNews, Reaction to reports on sea lice in Clayoquot Sound

Thanks Alison, noted.
Edits made below.

Dan

Issue: Reporter [REDACTED] has been in contact with the Department regarding a recent report from Living Oceans about the increase in Sea Lice resistance on the BC Coast. Reporter was sent earlier set of MINO approved lines, but has come back with additional questions.

Recommendation: Provide the following QA's to the reporter by email.

Approved by: Adrienne Paylor, Zac Waddington, Allison Webb,

Questions and Answers:

Q: The report states that sea lice are "out of control" at salmon farms on the west coast of B.C. this year because they have become drug resistant. Is this statement true?

- Sea lice levels were above threshold in a majority of Atlantic salmon sites (eleven total) in the Clayoquot region during the 2018 outmigration period. In the rest of BC, only three sites had relatively brief and minor periods where lice levels were over the threshold during this same period.
- DFO regulators have watched carefully for indication of SLICE resistance.
- Ineffective SLICE treatment is not necessarily due to resistance. It may be a result of: poor feed uptake, poor timing of treatment and/or environmental events (including low dissolved oxygen, harmful algal blooms, weather events etc.) which prevent a proper feeding. Prior to 2017, more than 95% of SLICE treatments in the Clayoquot area were considered to be effective.
- In regions where ineffective SLICE treatment has emerged, in the past it has been able to be reversed by a period of discontinuing SLICE use, and a introduction of genetically different lice from wild fish. In cases where the use of

SLICE does not result in adequate reduction of sea lice, companies can apply to the province of British Columbia for a permit to use alternative treatments, including Paramove (a hydrogen peroxide bath). Please contact Cermaq or the Province of BC's Ministry of Environment for further information on this process.

- DFO has been working with the province of BC and industry to develop alternative tools to manage sea lice. New treatment methodology, and husbandry practices are becoming widely adopted along the coast, which are reducing the reliance on SLICE to manage lice at sites. Some examples include: mechanical removal technologies (eg. hydrolicer), hydrogen peroxide treatment, area-based management (eg. coordinated treatments, stocking and fallowing of sites in an area) and pre-treatment of smolts in the hatchery with anti-lice medication. The rotational use of these technologies is part of an Integrated Pest Management approach, which has been demonstrated to reduce the need for drugs/pesticides, and prevent the development of resistance.

Q: The report claims Fisheries and Oceans Canada knew as early as 2014 that resistance was developing in sea lice, but did not take measures to ensure the protection of wild juvenile salmon from the parasite. Measures could have included alternate treatments for sea lice ready for deployment when SLICE failed. Is this an accurate depiction?

- DFO regulators have watched carefully for indication of SLICE resistance. DFO has been actively monitoring and analysing sea lice data for indication of SLICE resistance since 2011 and first noted concerns at Klemtu in 2015, Esperanza Inlet in 2017, and now Clayoquot Sound in 2018.
- Since the monitoring numbers in Clayoquot Sound from this spring was the strongest indication of ineffective SLICE treatment to date, DFO took action to perform a targeted audit and collected sea lice samples from Cermaq Canada's Bawden site and sent them to the BC Centre for Aquatic Health Sciences for analysis. SLICE resistance was confirmed by the lab. Samples were later sent to the Atlantic Veterinary College which is currently undertaking work to better understand SLICE resistance.
- DFO has supported the development and licencing of new lice treatment methodologies and continues to work in collaboration with BC and industry to make advancements in this area to address sea lice while minimising environmental impacts and risks to wild fish.
- Some examples include: the licencing for hydrogen peroxide use in BC, research into sea lice eating fish species, development of models to support area-based management, research into risk factors for SLICE resistance, the licencing of *Imvixa* (an in-feed drug used in hatchery to confer up to 9 months protection from sea louse infestation), and funding for implementation of various green technologies on sites.
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s.16(2)(c)

Please find the attached notifications for your perusal.

s.19(1)

The ones for Goat Cove and Sheep Pass are ongoing (updates from the last notification) the Mahatta West is new.

Best regards

Gender-related differences in EMB suscept
Stone et al 2002 Aquaculture 210:2
Efficacy: higher in PA ♀ than PA ♂
68% (lower) in adult ♂ than adult ♀
Westcott et al 2008

Sensitivity: ~~greater sensitivity~~
female PA more susceptible
than male PA.

Westcott et al suggests that
variance & time requirement makes
bioassay is for descriptive level studies
& trends, but not a resistance
monitoring tool.

Although not the
design, efficacy say
greatest in adult
♀, then adult male,
then PA ♀, &
lastly, PA ♂.

Dose 50 ug/d for 7 d
Stone et al fed in FW & lastly, PA ♂. 2002
at 9th day. Used eggs from ~~and~~ field

Mean #^s of *L. salmonis* challenged at day 109/113 w
copepodids. Counts 46 d later

	PA I ♂	♀	PA II ♂	♀	PA III ♂	♀
Control	0.1	0	0.1	0.9	2.5	1.7
Treated	0.1	0.1 ²	0.1	0.4	0.8	1

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